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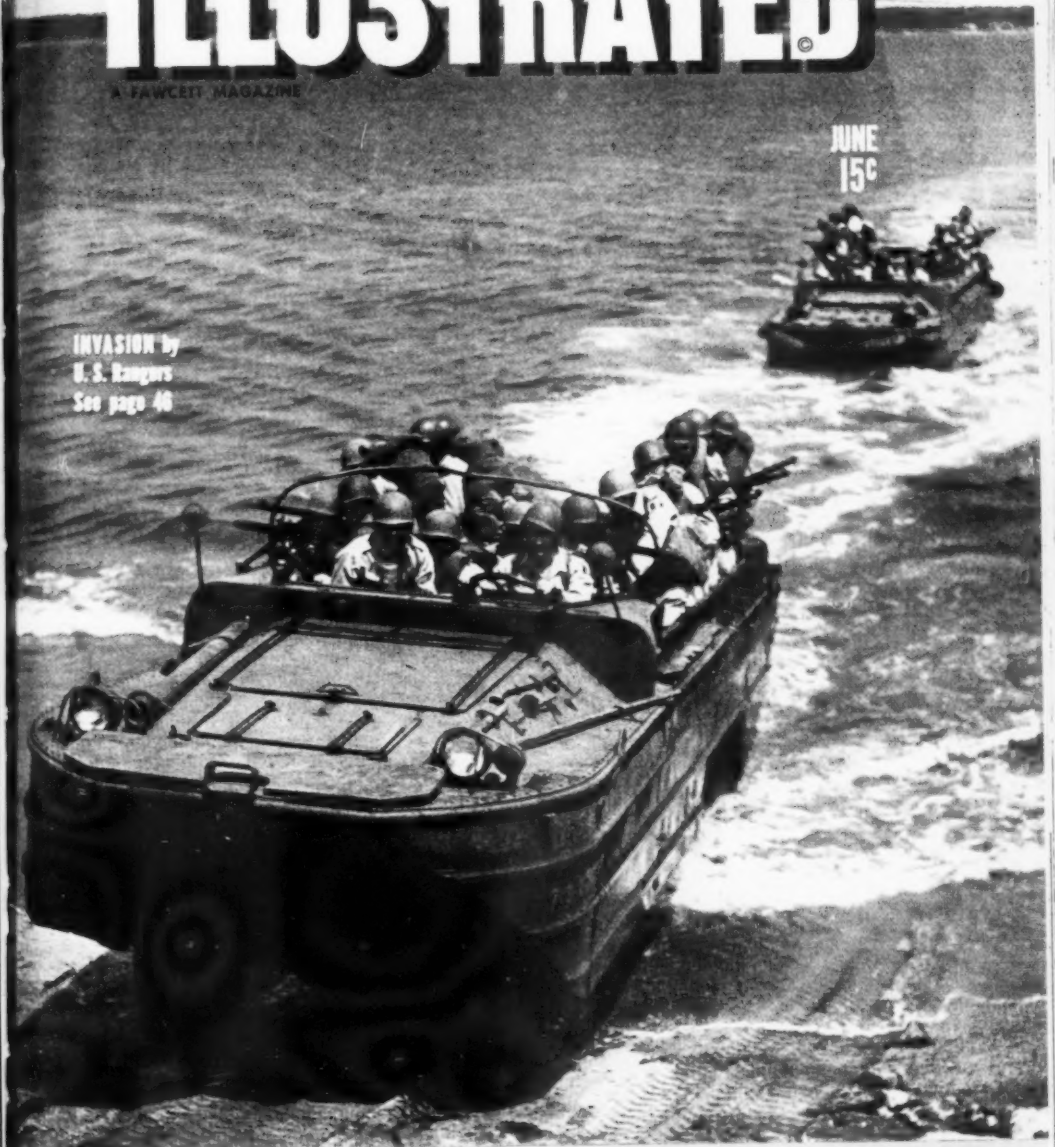

INVASION by U. S. Rangers
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HOW FIGHTER PLANES PROTECT BOMBERS

BY MAJOR WHITTEMORE

PRICE PRODUCTS HAS BOOM 1947 DEPRESSION

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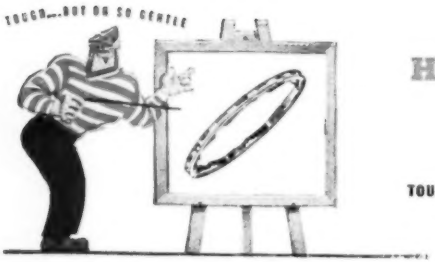

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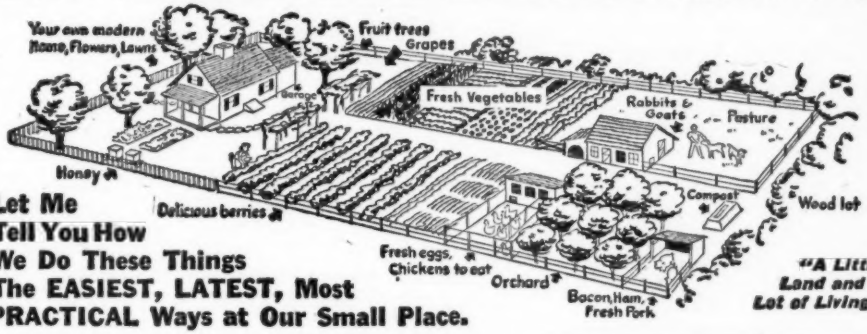
Have You Heard About My "HAVE-MORE" PLAN?

How to Raise Your Own Delicious Meat, Eggs, Vegetables, Etc. in Your *Spare* Time on as Little as ¾ Acre of Land!



"A Little Land and a Lot of Living"

Let Me Tell You How We Do These Things The EASIEST, LATEST, Most PRACTICAL Ways at Our Small Place.

Maybe you already are raising your own food—or at least part of it. Maybe you are even a full-time farmer. Or maybe you are a city-dweller just hoping and planning ahead.

Whatever your situation, I think you'll be interested in my Plan, because it's really a story—the true story of our place, of my family and me. It's the story of how we moved to the country outside of New York City . . . How I kept my regular job and how we've g o n e in for "backyard farming" in o u r spare time!

If you are already doing something like this you'll want to "compare notes" with me. Maybe I can give you some new ideas . . . short cuts . . . help you get better results.

If you are not yet doing it, but are planning to, you'll find my Plan very helpful. It will tell you how to look for the right kind of place near your job, how to get started the easiest, most inexpensive way. My Plan will show you lots of short cuts, help you avoid many mistakes.

"One Hour a Day"

Some people may think this sort of thing takes a lot of hard unpleasant work. That is not so! It does take some time—but really not very much. We take care of the chores at our place in only one hour a day on the average! It does take some work, but it's not unpleasant—it's fun! And it does not take much land—even a fairly large city lot can be enough!

The secret, of course, is doing things the easiest, most practical ways, taking advantage of all the modern, scientific, labor-saving methods that have been developed in recent years! And it is these new, easier, better methods that my Plan tells you about! See right hand side of this page for list of things my Plan covers.

Mrs. Robinson and our son, Jack. The home-raised goose I'm holding weighed 10½ lbs. at 10 weeks of age. All the food it ate was stale bread and grass growing around our place.

Healthful, Relaxing

Not only is it fun to have a garden, and to raise lots of the other foods you n e e d — it's healthful. Really fresh vegetables, milk, eggs, meat, etc., have more vitamins and other health giving qualities in them. They taste m u c h better—and, of course, raising your own you can have all you want, without worrying about ration points!

Being outdoors around the place is healthful, too. The whole family eats better, sleeps better, feels better and gets along together better. Your children, if you have any, have more wholesome surroundings. This "way of life" is really the soundest foundation for family happiness.

Saves on Food Bills and Ration Points

Food prices are very high now—everybody knows that! So, just figure out how much you'd save if you raised 50% to 75% of all the food you buy! Not only that—it doesn't take any ration points to raise your own! You can have more food, better food, and save money doing it!

Security Against Hard Times

Maybe you'd like to retire some day. If there's a postwar depression, you might even lose your job. I hope not, but it might happen, and if it did, wouldn't it be swell to have a place where you could raise most of your food, where you could get by with very little cash income? Wouldn't it be a good idea to know how to do these things even if you never have to? I can tell you it sure gives me a feeling of independence and security and I'm sure it would do the same for you!

Well, I guess you can see I'm pretty well "sold" on this whole idea. It's fun, it's healthful, it saves you money, you eat better, you feel secure and independent. That's why I've told the whole story about it in my "Have-More" Plan, and why I'm offering my P l a n for sale. (Price $1.00.) I wish I could give it away to everybody that might be interested, but of course I can't, and after all one dollar isn't very much.

So, if you're interested either to "compare notes" with me or to plan ahead—then send me your name and address and one dollar and I'll send you my Plan by return mail.

Right now is an excellent time of year to start!

Yours for "a little land and a lot of living"—

Ed Robinson

NOT A BOOK!

50,000 WORDS . . . 73 PICTURES, DIAGRAMS

My "HAVE-MORE" Plan tells, by clear-cut diagrams, pictures, easy-to-read directions, tables, charts, etc., how we have applied the easiest, most practical, labor-saving methods to having such things at our place. You can easily do the same.

How to choose—to rent or buy—the right kind of a place of your own, near your job. (If you don't already have a place.)

A wonderfully bountiful garden with half the work.

Broilers and roasters—at about 16 cents a pound.

Fresh eggs—7 minutes a day.

Delicious rabbit meat—at 8 cents a pound.

M i l k, butter, cheese from your own miniature dairy.

Pigs are easy—why pay to have garbage removed?

Geese, turkeys, squabs, ducks — easy, interesting, delicious.

A lovely flower garden for mother.

New amazingly e a s y ways of preserving foods —they taste f a r better, too.

75 pounds of honey—only 8 hours' work.

Extra income selling your surplus crops.

Fruit instead of shade trees.

Grapes, berries — your investment b a c k e a c h year.

Etc., Etc., Etc.

What My Plan Tells You about any one of these things can easily be worth several times the price of the whole Plan (which is $1.00). So even if you are interested in only one or two of the subjects you need not hesitate to order my Plan. Besides, if for any reason you aren't more than satisfied with it, I'll gladly refund your dollar without question!

DO YOU WANT TO SEE MY PLAN?

If you do, just put a dollar bill or dollar money order (if bank check, $1.05) in an envelope with your name and address and turn it over to Uncle Sam's mailman. I'll send your copy of my Plan by return mail. If for any reason you aren't pleased with it, let me know and I'll refund your money without delay and without question. Address:

Ed Robinson, Box 507, Noroton, Conn.

Your Name_____

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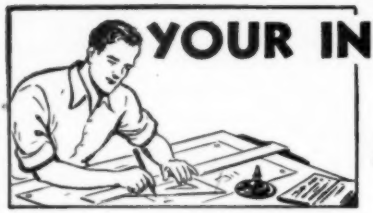

YOUR INVENTION CLINIC

Conducted by

JOSEPH H. KRAUS

Mr. Kraus has been giving advice to inventors for more than 20 years. He will attempt to answer as many letters from inventors as possible in his column each month. Mr. Kraus will "call his shots as he sees them" in this column. Thoroughly versed on inventions and inventions procedure, he will never, under any circumstances, disclose any valuable secrets. He cannot answer questions relating to patent law. For such information, the Editors suggest you communicate with any one of the patent attorneys who advertise in MECHANIX ILLUSTRATED.

S. S. Powers, Kansas City, Mo., states that he has spent hundreds of dollars on the design of an electrically-powered plane for use by commercial airlines. Power to the airplane would be delivered from cables running to a trolley which picks up the current from bare wires.

ANSWER: *The "dream" for this type of airplane appeared in popular magazines as early as 1919; it was revived again in 1921. You have contributed nothing new to the original scheme which, as you are well aware, was never put into practice except on small toy models. Unless you can improve greatly upon the old systems we would recommend that you forget about this idea. It is not likely that it will come into use during the next seventeen years.*

Drilling Jig

Charles Simmons, Smyrna, Delaware, submits a design for a drilling jig and states that he has never seen anything like it on the market. He wants our opinion of its value.

ANSWER: *In nearly every plant where many parts are to be drilled to exactly the same pattern a drilling jig similar to the one you designed is in use. We do not believe that you could get sufficient protection on this system to warrant the expense of a patent; nor do we see how you can hope to benefit commercially from such protection. The general scheme has been in use for too many years.*

Never-Fail Clothes Prop

John Fidura, Koppel, Penna., submits a design for a clothes prop with a clamp at one end and a mechanism for releasing said clamp.

ANSWER: *In our opinion you have designed a very complicated mechanism to perform a simple function. An ordinary piece of steel wire, passing through two holes drilled in the wooden clothes prop, will work just as well; a simple hook, operated with a string, will do likewise. We would recommend that you forget it.*

Auto Speedometer-Governor

Roy E. Naill, Rockford, Illinois, states that he has perfected a very simple switch which can be attached to an auto speedometer and can be set at any predetermined speed desired. It would then control the carburetor to maintain that speed.

ANSWER: *The trouble with most automobile speed governors is that they do not permit of satisfactory flexibility. Thus, it sometimes becomes necessary to pass another car on the road. If the car is travelling at, let us say, 33 miles an hour, and the governor is regulated for 35, it takes a long time to effect the passage. This is likely to prove dangerous. Again, in travelling down hill, the car is likely to accelerate to a point beyond the speed for which it was pre-set.*

If the equipment you have designed will permit of instant attachment to the speedometer of any car without requiring the services of a trained mechanic, and if it will take care of all the variable factors as well as permit of manual manipulation of speed in event of emergency, we would recommend further action. Otherwise, we would advise against that procedure.

Automatic Gear Shift

Pfc. Henry Grimes, Florence, South Carolina, wants to know if we believe it would be worth his while to continue experimenting with an automatic gear shift which will drop the gears into place depending upon the speed of the car.

ANSWER: *We certainly do. We assume, of course, that you will be ready to change your plans for this mechanism should there be a tendency toward hydraulic or electrical drives. Such drives would eliminate gears entirely and yet permit of the application of full torque to the rear wheels even when the car is moving at a speed of less than a mile an hour.*

There are several points in your design which apparently you have not considered at all. We assume that the gears will function as you described. Just exactly how do you propose to control the car when it is rolling freely down a steep grade? Again, it would seem that on bumpy roads the gears would be shifting back and forth. You should allow for at least some flexibility of the engine rather than depend upon shifting gears for such variables.

INVENTORS

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CHIPS *from the* EDITOR'S WORKBENCH

WE PROUDLY ANNOUNCE that the magazine you like best will blossom forth in its July issue like your Victory garden. When you get your copy early in June, that month of color, you will find that MI has a new four-color section to highlight the usual red, blue, black and white of the magazine with Science in Color, Articles and Stories in Color. Importantly bright as this addition will be, there'll be no addition in price. Keep those fifteen pennies for a treat. Or—far simpler—take out a year's subscription and be sure of getting twelve copies of the brand new MECHANIX ILLUSTRATED.

For The Hobby Fan—For July

HOW TO TIE ONE ON—Not what you may think; this one's for fishermen. The low down on fly tying and plug cutting by two outstanding experts in the field, Herb Howard and Fred Hildebrandt.

BRISTOL BOARD MODEL SAILBOAT—Precise sailing model of developed hull plywood sailboat, designed by William F. Crosby, well-known designer of yachts and Navy craft, including the Snipe, Sea Gull and many others.

ART OF POTTERY MAKING—First of two articles on this fascinating handicraft. The article will cover all phases of it, including instructions for making inexpensive pottery wheel. By R. H. Jenkins, Ceramics Instructor, Humboldt State College, Calif.

Forecasting Features

WEATHERING THE WAR—by Bernard Wolfe. The science and art of weather prediction, as much as ninety days in advance, to aid our war effort and simplify transportation problems for the peace travel to come. A four-color article.

THESE ARE THE PLANES THAT WIN—a kodachrome spread of the Army and Navy planes that are blasting the Axis to defeat.

AND A PIP of a story from England by Dick Hanser about the guys in the guts of the ships that sank the mighty Scharnhorst.

Sperlash!

ARCH WHITEHOUSE, MI's European war correspondent, is back home for a rest and has brought with him what we think is one of the funniest stories of the war. Arch picked it up talking with a group of fliers at the Savoy Bar in London. One of them was an American Thunderbolt fighter pilot who was barracked at the home of a wealthy Englishman. The pilot, whose name may not be used for reasons which will become obvious, related how his English host had come to him and said,

"I want to do something for you, since you are over here helping us with this fight. We haven't much of anything, you know, but I have saved a bottle of brandy and I want you to have it."

The Englishman went to his wine cellar and produced a bottle of hundred year old brandy, covered with cobwebs, and presented it to his flier guest.

The American was leaving immediately on a mission, so he stuffed the bottle of brandy into the leg of his flying suit and took off with it.

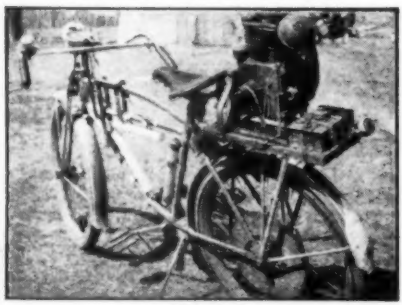
Off the coast of Holland, the pilot had a brush with a flock of ME's and was shot down. He landed in the North Sea, but managed to toss out and inflate his rubber life raft and scramble aboard it safely.

He was soaked to the skin and cold, but, taking inventory, he remembered the bottle of brandy. A few swigs of its ancient fire restored his strength and morale.

Late that afternoon, a British crash boat spotted the American pilot's life raft bobbing around on the sea and pulled alongside.

[*Continued on page* 148]

100 MILES PER GAL. SINCE '42



Eugene Horn, Box 135, Eldorado, Ill., built this motor bike from MI plans, with a few minor changes. It cost him about $25, including the motor. He tells us that it has been in operation since the middle of November, 1942, getting approximately 20 miles per hour and 100 miles to the gallon of gas. It gets even better gas mileage on straight runs. Pulley belt wear has been the only mechanical trouble encountered. This snapshot nets Mr. Horn a $5.00 Workbench award and a Certificate of Merit.

KWAJALEIN PAY-OFF

"The flame and roar of our main 16-inch battery splurted across the sky toward the enemy island of Kwajalein, firepower that kills at 20 miles."

Walk through the front door of the Marshalls with the mightiest task force in history.

by Will Oursler

MI's Pacific Theater Correspondent

THE ships crept silently through enemy waters in the dark hours before dawn. Destroyers and transports, cruisers and battleships—vague, formless shadows in the night, moving with slow purpose to the kill. The big show was almost ready to begin.

For many hours we had been within the Japanese "search area" but so far as we knew we had not been sighted. Several times we had rushed to battle stations on reports that enemy planes or subs were closing. Once our covering planes dropped depth charges, sending up great spirals of foam into blue Pacific skies.

Nothing developed from the scares. The mightiest combat task force in history had walked through the front door of the Marshalls without even a bomb's worth of greeting from the Jap.

Our job was Kwajalein Island itself at the southern end of the atoll. At the northern end, another strong American force was hitting Roi Island, eighty miles distant.

Suddenly, orders were barked from bridge to below decks. In the eerie darkness, the flame and roar of the main 16-inch battery splurted across the sky toward the enemy island of Kwajalein.

The big show was on—the invasion, with its terror, its inferno of death and destruction.

An enlisted man, standing on the deck of our battleship, let out a yell as the main battery fired. "Reveille, you slant-eyed bastards," he shouted. "Reveille!"

The tempo of invasion started with minor but vital action. Two small islands off Kwajalein Island itself had to be occupied before the main assault.

Island A had been seized a few hours earlier by American Assault Troops. The fight had lasted only a few moments.

Now small landing craft headed toward Island B, followed by heavily loaded LST's and the smaller LCI's bringing in infantry and supplies.

In the darkness, rocket guns blazed red. Tracers shot out from the guns of the LST's and the other ships as they hit the beach.

17-35
OK

shattering the feeble enemy opposition. For the first time, our troops were occupying actual Jap territory.

Even as our forces swept across Island B, our battlewagon and others were pouring salvos of high explosives into the main objective of Kwajalein, the strongest Japanese fortified position in the Marshalls.

Kwajalein would be tough. The Japs had had the island more than twenty years. The system of pill boxes and blockhouses was expected to be far more complicated than that found at Tarawa in the Gilberts.

But the high command had determined on one thing weeks before—there would be no more Tarawas.

The answer was that the hidden pill boxes and blockhouses and other fortifications had to be smashed to rubble before any landing was attempted. Bombs would help but alone were not enough to do the job. The only other possibility was naval bombardment—bombardment on a scale never before known.

For the job they needed one ship to take on the main burden. One solidly built, stubborn vessel to be used as a workhorse of destruction, sitting in close to the beach and laying it on the line, pitting the skill of the gunners on board against whatever the shore batteries could throw at us from the island.

The battlewagon on which I rode fitted specifications. The crew affectionately called her the "Iron Bound Bucket." The Navy knows her as one of the heaviest armed and best shooting ships afloat.

So the brunt of the job was ours, the wiping out of the pillboxes on the beach, the blasting of any shore batteries that opened on us, the crumbling of heavily-protected blockhouses. We were to go in close and square off against them.

It rained heavily during the early morning, at times blotting out the island. But we kept laying in shells. Then the rain cleared and we had a chance to see the incredible scene around us.

Ships were everywhere, all the way to the horizon. Destroyers and cruisers and battleships stood off Kwajalein. Minesweepers darted in and out, charting unknown waters. LST's lumbered along in solemn columns toward the beaches of Island B. Transports lay off several miles, out of gun fire range.

Ahead of us—Kwajalein—low lying in the water, a green strip of palm trees, a curving finger barely two and a half miles long and only a few hundred yards wide.

One of our planes, circled over the island. Occasionally, from hidden positions, bursts of anti-aircraft fire sent dark puffs under his wings.

Most of our shots were close on the target. Looking through glasses, you could see huge chunks of cement thrown up as high caliber shells found the mark.

When we were off the target, the plane would report in: "That was in the lagoon. Bring it down a little."

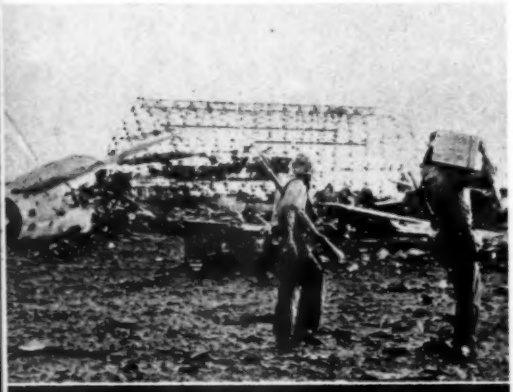
Our big ship now was sneaking in closer to the beach at the southwest point of the island. There was a cement wall here, and there was the possibility of shore batteries behind it. There was a tenseness on board as we moved in. So far, except for a few feeble bursts of artillery, the Japs had not answered back. If they were going to throw anything big at us, this was the time.

Small boats early that morning had collected the first Jap fire when they had gone in to the same point to make soundings of the water and reefs.

We watched from deck as our ship and one other battlewagon moved closer and closer to the beach. All the time we were pouring out a hailstorm of red hot shells.

There was no answer from the beach. The Jap was at his old game—sitting in holes in the ground, holding fire and waiting. Next morning, when the troops started in against the island, the Jap would open up.

For half an hour we and the other battlewagon stood virtually dead in the water, pounding the wall. Then the small boats which had been driven off before started in a second time. On this second attempt they drew no fire.



Complete devastation at Roi, Kwajalein Atoll. Our Marines found hangar skeletons, plane junk.

The boats completed their work in close without opposition, then all of them started back to their ships—all but one, which remained in close. I wondered if anything were wrong and took a squint through the glasses. I saw three men standing up in the boat and peering at the beach.

"They aren't hurt, anyway," I said. "They're giving the beach a once over."

A lieutenant standing beside me laughed. "Sightseers. Out to see the points of interest. This is a hell of a war."

When the boat withdrew, our ship started on its afternoon assignment, the bombing of special targets up and down the island.

It was done slowly, methodically, according to plan. Each shell fired by the "big boys"—the sixteen inchers—and the other batteries had a job to do, a special blockhouse or building marked for obliteration.

All afternoon, up and down the island, we poured it in, assisted by several other ships standing by. The island itself began to change shape. The verdant palms withered, taking on a haggish, worn-out aspect. You began to see great gaps in the trees where heavy foliage had been before.

You grew used to the noise and smoke and smell of powder. Even when the ship lurched back as the shells hurtled out, you found yourself taking it for granted, part of a day's work.

I looked below to the boat deck, watched the "hot shellmen" handle with heavy gloves the hot shell cases tossed out.

We kept up our fire all that afternoon. The cracking blast of our guns and the thud of explosions and puffs of fire and white smoke on Kwajalein grew almost monotonous. Nearing six o'clock, we made a final run along the island, pouring it out from everything. They even allowed one of the forty millimeter batteries to fire. A ship's officer explained that they didn't expect the 40's to do much damage but they wanted to give the boys a chance to shoot.

At the midway point on that final run of the day, one big shell hit an ammunition dump and blew it to kingdom come. A great wave of blackish smoke lifted up hundreds of feet in the air. The late afternoon sun hit the billowing vapours and tinted them gold.

This was the greatest concentration of high explosives ever hurled at a space so small.

With the ammunition explosion, we completed our bombardment of the island for the afternoon. As the ship pulled away, bugles blew over the loud speaker and the order went out, "Secure from General Quarters."

A cheer went up from the men. We had been at general quarters for more than twelve hours, with no letup except for a few minutes' break when sandwiches and coffee were served to the men.

Fellows in blue dungarees were running up and down the ladders, chattering like stenographers on their way home from the office in the five o'clock rush. In the hubbub I heard one fellow laugh. "Thirteen hours of General Quarters. Wonder if they're going to pay us overtime."

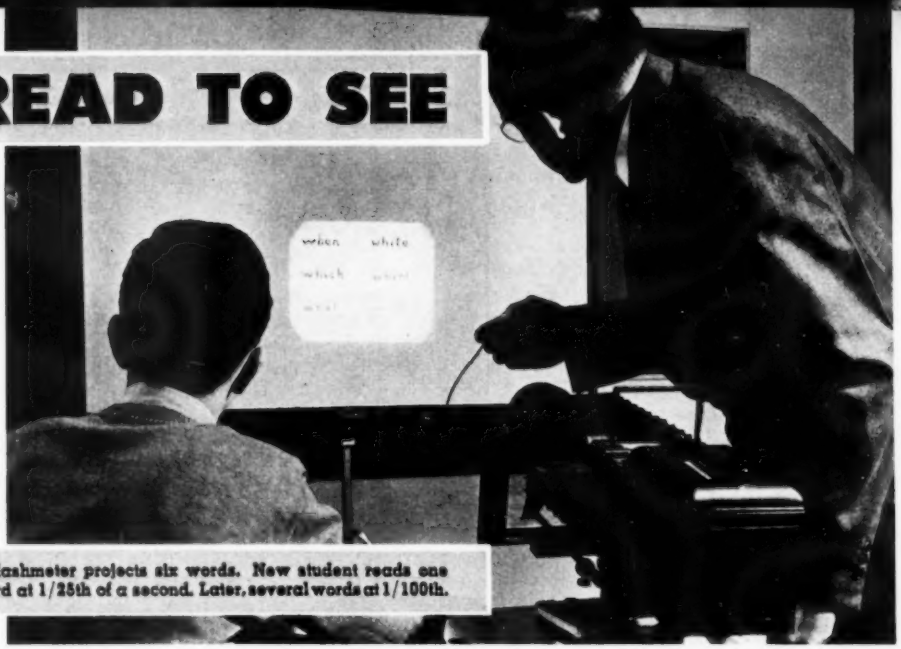
But it was only a few hours' relaxation. Tomorrow loomed ahead of us. Tomorrow, the big day.

The show began early once more, in the gray, half-darkness [*Continued on page* 82]

After naval bombardment and Marine landings, dead Japs lined the trenches on Namur Island, Kwajalein.

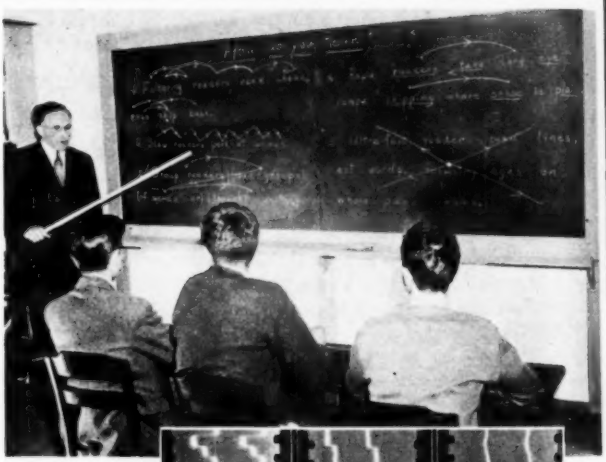
Plan before a task force assault. Strategy is planned by an admiral and captain on maneuvering board.

READ TO SEE

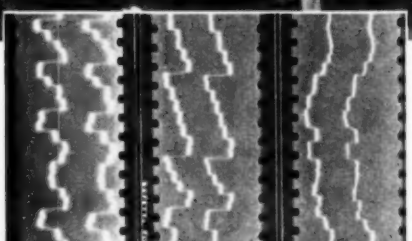


A flashmeter projects six words. New student reads one word at 1/25th of a second. Later, several words at 1/100th.

THE Carteret School, West Orange, N. J., is doing something about the fact that fifteen million Americans cannot read above sixth grade ability. George Hofe, the school's president, believes that bad reading habits account for most poor reader cases. He established a reading center, brought in scientific method and apparatus. Poor readers tire, become irritable, dread desk work and don't realize why. These school boys are taught best reading methods.



H. S. Laity, reading center director, identifies the five types of readers.



Photos of eye movements of three students. At left, poor reader—center, good—right, rapid.

The metronoscope's panels close from left to right so that pupils cannot retrace reading.

Mechanix Illustrated

Spurred by his vision of eternal youth, Ponce de Leon reached Florida in 1512 in quest of a fabulous, life-prolonging fountain. A Russian medico may succeed where he failed.

LIFE BEGINS AT 140

by John Frank

Ponce de Leon had nothing on Professor Bogomoletz, whose Fountain-of-Youth serum may ultimately add one century to man's life-span.

ON JUNE 23, 1941, less than 24 hours after Adolf Hitler had struck at the Soviets, a small group of reporters gathered in the office of Professor A. A. Bogomoletz, director of the Kiev Institute for Experimental Biology and Pathology.

A man with a high-domed forehead and a sly, youthful smile in his watery Slav eyes looked up from his papers. In an engaging voice, carefully picking his words, Professor Bogomoletz announced a man-made Fountain of Youth. He had perfected a serum called ACS, destined to prolong human life to what he termed its normal span—125 to 150 years. The reporters listened in silent respect. Coming from this modest, retiring man of science, such an announcement could not be brushed aside lightly. He was known to have worked on problems of longevity for nearly two decades. Since 1930 he had headed one of the world's foremost scientific establishments in the field of body chemistry and biology. For his outstanding work he had been made Chairman of the Ukrainian Academy of Sciences, member of the Supreme Soviet Council, the highest government body in the land, and member of the Ukrainian Supreme Soviet Council to boot.

ACS serum hasn't prolonged any lives yet, but it's saving plenty of them. Doctors on the Russian front have discovered it works wonders in double-quick wound healing.

Overcoming his inborn shyness, the Professor explained that a life span of 50 to 80 years is not the time allotted to man by nature, but the toll exacted by the ills of unnatural living. Animals, he said, outlive the period of their maturation by five to six times. Man matures in about 25 years. Therefore, he should reach the age of 125 to 150 years. The new serum would in time allow people to marry off their great-great-grandchildren.

While the Professor was carried away by his vision of man's happy biblical age, the reporters fidgeted politely. Their ears were straining toward the not too distant West where the Germans were blazing a swift path of death and horror. Under their very eyes, the Professor's assistants were feverishly packing up. The Institute was moving to far-away Ufa, behind the Urals mountains.

The promise of a merry long life sounded rather unconvincing against the thunder of bursting bombs. The reporters hurriedly disbanded and gave the Professor a few paltry words in the miscellaneous news.

With philosophical indifference, Professor Bogomoletz pursued his scientific labors. A number of his staff workers joined the Army, wrestling with disease and mangled bodies. Like medical men all over the world, they moved right up to the front lines to tend the fighting men.

On such a mission, Doctor V., Russian Army surgeon, got into an ugly scrape. A German machine-gun bullet shattered his right leg beyond recognition. With a festering wound and broken bones that refused to mend, he spent agonizing months in a field hospital. His colleagues had given up. There seemed only one way out: amputation.

In the last minute of despair they tried something new. They gave him three very carefully measured injections of Professor Bogomoletz's ACS serum. It did what he knew all along it would do. Within a few weeks' time, the doctor's leg was back to normal. A healthy, solid scar formed over his wound. The bones knitted together perfectly. Soon he returned to the front.

Thus, before another year was up, the Professor was back in the news again. In July, 1942, forty of the best Army surgeons reported before his Institute in Ufa on the sensational healing action of the new Russian Magic Bullet. Professor Bogomoletz's ACS (abbreviation for Anti-reticular Cytotoxic Serum, meaning a serum which acts upon the cells of the connective tissue) had been tried out in several thousand cases. Sixty per cent were remarkably successful. Doctors hoped to improve the score in the forty per cent where ACS was still ineffective. Not a single case showed harmful results.

Bogomoletz lays great stress on the

connective tissue. The human body's main support, to be sure, consists of bones and cartilage. But surrounding the bony skeleton is another, "soft skeleton," a complex structure of elastic tissue, composed of cells interspersed with fibrous matter. This holds the body organs together, provides them with an inner and outer lining. It's a network of communication whose maze is infinitely more intricate than the gas and water conduits and the light and power cables buried under the streets of a modern city.

Before Bogomoletz, few scientists had paid much attention to the physiological processes that take place in this connective tissue, regarding it merely as a passive agency of elastic support. They were all wrong.

Bogomoletz found, first of all, that the cellular working bees of this tissue perform a *trophic* function. That means they provide food for the body cells. They help in breaking up the substances supplied by the bloods and the glands, regulate metabolism.

Then they have a *plastic* function—they bulk large in the regeneration of tissues and cells.

Finally, they have a *protective* function, for they are the area in which anti-bodies in the fight against infection are first produced. These anti-bodies, called phagocytes, are cells that consume microbes and other foreign substances.

Thus, like every great discovery, Professor Bogomoletz's findings reduce themselves to a few simple facts. The connective tissue is the body's first line of struggle for the renewal of living substances. It is also the first line of defense against illness. Once this first line of battle breaks down the organism declines, illness or old age sets in. "Man's age is equal to the age of his connective tissue," says Bogomoletz. If you want to prolong man's good health and life span, prolong the good work of his connective tissue. That's where ACS comes in.

For 18 long years, Bogomoletz searched for a serum that would stimulate the connective tissue. A believer in teamwork, he gathered a staff of 37 top-notch scientists, including his own son, Oleg. With government funds he established in 1931 the Kiev Institute of Experimental Biology and Pathology. He and his co-workers pored over every detail of human biochemistry. By 1936 his work had become so promising that the government increased his staff to 60 men of his choice. He moved to a new four-story building, with hundreds of work rooms and vast laboratories, two experimental stations for animals, and its own publications.

Finally he licked the problem. He succeeded in extracting a serum from the blood of horses that had been injected with spleen and marrow cells taken from human corpses. This serum worked wonders. It proved its worth on animals. Since 1936 it has been used on human beings. Large doses of it block, and small ones stimulate, the physiological functions of the connective tissue.

ACS was put to such widespread uses as wound healing, knitting of bone fractures, combatting infectious diseases, high blood pressure, stomach ulcers, tuberculosis, arthritis, severe frost bite, shock and mental disorders. Soldiers who would normally have spent from 4 to 6 months in hospital care were back at the front after 6 to 8 weeks.

Early this year, Professor Bogomoletz made international front-page news. The Russian Government pinned the Order of Lenin and the [*Continued on page* 140]

Prof. Bogomoletz, at 60, is sure he has lived only "half of his natural life."

A formation of Thunderbolts, world's largest and heaviest fighters, sets out to keep a rendezvous with the bombers.

WE'VE GOT

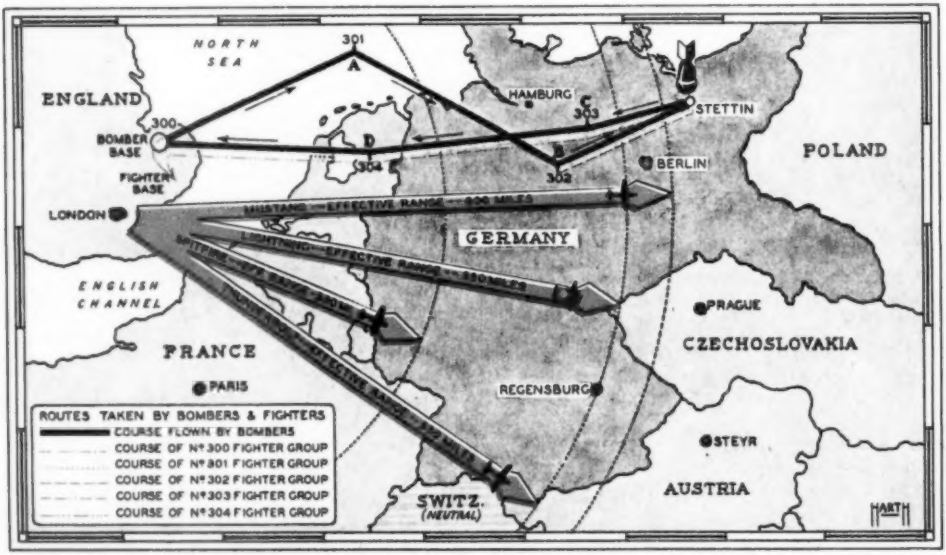
The first full story on how we provide fighter cover for our bomber armadas—told by MI's correspondent in England.

WE ARE now able to write and speak of a good many things that were very hush-hush a few weeks ago. Over here you soon learn that there are two directives concerning censorship and security. There's one in effect over here in Britain and another in force in the United States. I am not the first war correspondent to notice that while we overseas are on our honor to keep certain secrets our opposite numbers back home in the United States appear to operate under a more flexible code.

The General Patton episode is an outstanding example.

Then again we notice that certain aeronautical experts are allowed to write that because of certain limitations in our fighter aircraft, "an attack on a target 500 miles from English fighter bases would require at least four separate fighter escorts."

The limitations hinted at concern the range of our best fighting aircraft. But now that the Stars and Stripes has come out with a photograph of the very hush-



Here's the set-up for a hypothetical bombing raid on Stettin. Our fighters, unable to convoy the bombers all the way, go to work in complicated shifts.

'EM COVERED

by Arch Whitehouse

hush and still much publicized North American P-51b showing two droppable exterior gas tanks, there should be no reason why we can't come out flat-footed and admit that our fighters cannot carry out long range escort jobs without using belly tanks.

When I arrived in Great Britain early in November there was considerable excitement and much mysterious hush-hush business about the new North American Mustang fighter. I had crossed with many young pilots who had been trained on these planes and there was much undercover chatter about the range and combat characteristics of these machines. Once I had reported at headquarters in London, it was plain that the P-51b was really on the secret list. We were not allowed to mention it and I was discouraged from attempting to get on a P-51b field.

A squadron of hard-hitting Spitfires. These short-range British fighters usually provide protection for the first leg of the bombers' route.

The public relations men who were most friendly advised me to try a few bomber and Thunderbolt fighter fields first and then, once the new P-51b squadrons went operational, I might be able to get inside and see one of these aerial masterpieces up close. I might add too, that the under-cover hoop-la we got concerning the characteristics of the P-51b was really something. From all accounts it was to put the rest of the fighter equipment on the shelf. This belly-tank business which was hampering the escort work of the Thunderbolts and Lightnings had been completely eliminated, we were informed. The new P-51b, so they told us, had range enough to escort bombers to any point in Germany—and come back again.

I naturally inquired just what this new North American fighter had that none of the others possessed. I was assured that it carried no exterior belly tanks but that because of new interior tank arrangements and because of the new economical Rolls-Royce engine which had been built by Packard, gas consumption had been cut way down.

That piece of information, startling as it was, appeared to explain the long range of the P-51b. We knew she carried plenty of armament and that she was a well-designed plane. The British had been raving about the characteristics of the Mustang for nearly two years, and now that we had been assured she had the necessary range to do a real bomber escort job, most of us sat back, content to keep the great secret and assure the bomber boys that it was now only a matter of time.

Then, just as we were quietly revelling in the reports that the new P-51b fighter was actually taking part in long-range escort missions over Germany, out comes the Stars and Stripes with a picture of the aircraft.

It was just another P-51 Mustang with *two* wing tanks, instead of the usual one under the belly, such as is carried by the extended-range Thunderbolt. Two exterior tanks instead of one is what gives the new Mustang this extra range!

All that wouldn't be too bad were it not for the fact that these exterior gas tanks do not add to the maneuverability of our fighters. As a matter of fact, one young Lieut. Colonel who has about a dozen enemy planes to his credit told me that any fighter attempting to engage a Focke-Wulf 190 while carrying an exterior belly tank, was practically a dead duck.

Perhaps all this hush-hush business and all these misleading statements dished out, even unofficially, are part of the great security system. Of course, the Germans are not supposed to know anything about this belly-

tank business. Our fighter escort must have dropped enough empty belly tanks on occupied France and Germany in the past six months to have built a pontoon bridge across the Rhine fifty feet wide!

However, to be perfectly fair, and belly tanks or no belly tanks, the U. S. Eighth Air Force was the first offensive organization to provide fighter coverage for their bombers all the way into Germany. The Royal Air Force has since produced the DeHavilland Mosquito, a three-purpose plane which can operate as a fighter, a light bomber or a high-speed reconnaissance plane. It has played the part of an escort fighter on the daylight attacks carried out by light and medium British bombers, but, to the credit of the Americans, they were the first to carry out a long-range mission into Germany and provide fighter cover all the way. The British, whose long raids are usually carried out at night, require no fighter escort.

To make the bald statement that we provide complete fighter coverage for our bombers does not mean however that a formation of bombers takes off from a base in England and is picked up and escorted all the way to their target and back by a group of Eighth Air Force fighters. So far, we have not been able to do that, but we have provided fighter coverage to targets about 600 miles from the home base. Until the appearance of the new P-51b which has just gone into operational work, no fighter in either the U. S. Air Service or the Royal Air Force has been able to do a complete escort mission. But as explained before, even the P-51b has to carry two outside wing tanks to augment the fuel supply carrier inside the structure of the aircraft.

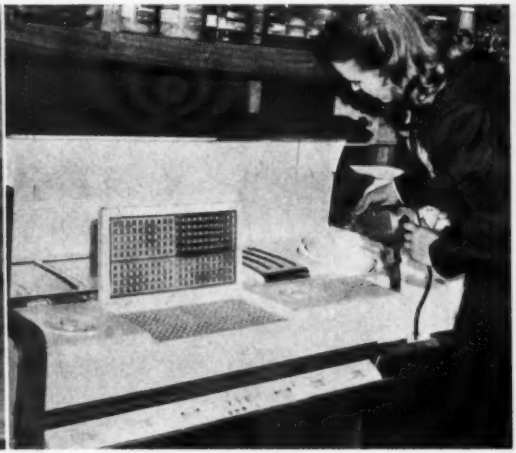
Let us sift through the actual facts and see what this bomber-fighter problem adds up to. Let us presume, for instance, that the High Command has decided to make an attack on Stettin, an important shipping and dock base on the Baltic coast of Germany. The actual mileage as the crow flies from the average bomber base in Britain is about 575 miles. A round trip, then, would require approximately 1,150 miles of direct-line flying.

But no mission by daylight is ever flown on the direct route, either on the ingoing leg or out. The accompanying map will show a possible route taken by the bombers, a route which will run the actual air-mileage to something like 1,500 miles. On top of this we must also consider time consumed in the air as well as mileage, for there is a certain time lag in assembling the formation and dispersing for the run-up over the target. In other words, an attack on an enemy base 575 miles away can consume an air mileage program of nearly 1,700 miles.

It would be splendid if all our fighters had a range of 1,700 or even 1,500 miles, but, unfortunately, they haven't. We must also remember that if we send 350-400 mile-an-hour fighters out to give protective cover to a group of 250-300 mile-an-hour bombers, there will have to be considerable zig-zagging on the part of the fighters to keep station with the bombers. All this necessary maneuvering and zigzagging consumes extra fuel and by the time the bombers have been escorted a distance of 200 miles, the escorting fighters have probably flown at least 250 or 275 miles. If in the meantime an air fight takes place, the fighters will consume even more valuable fuel. These are not the figures of the writer. They were given as approximations by fighter pilots who have done dozens of these escort shows. They are offered in this instance as [*Continued on page* 144]

Bomber crews fete airmen who fly the fighters. Written on cake: "God bless the pea shooters."

Refrigerator opens into kitchen and dining room, has spaces with individually controlled temperature.



A comely baker's dream—this unit. Built-in waffle iron, electric mixer, its own lighting in the hood.

FUNCTIONAL KITCHEN

YOUR post-war kitchen is designed to save the most space, be in harmony with house decoration, eliminate much walking and stooping, have units that can be closed when not needed to make it a room for other uses. Foot pedals allow more use of the hands, height of most equipment permits the housewife to be seated while working. Shelves for storage are conveniently placed. The cleaning problem is considerably lessened.

The combination oven, pan-frying griddle and rotary barbecue are all raised to this comfortable height.

The sink-dishwasher. Water is controlled by foot pedal, freeing hands—no fixtures jut up, has own light.

TERROR-TROOPERS

by E. H. Kelly

"Will you kill without squeamishness?" You have to answer yes, and prove it, if you want to be a Ranger in the American Army.

RECENTLY a grim story was revealed—the heroic and hopeless last stand by the American Rangers on the Anzio beachhead.

It began simply enough—what was for the Rangers a routine assignment to infiltrate behind the German lines at Cisterna and "terrorize." An attack on the German positions there was planned for the next day. The Rangers' job was to spearhead the attack, moving in by night to create confusion among the enemy at dawn when the infantry would approach from both sides.

Two battalions set out at 1:00 a. m. on January 30th. What little is known of what happened to them after that came back to headquarters over their portable radios. By dawn it was obvious that something had gone wrong. The infantry did not arrive. German reinforcements poured into the Cisterna area and by 8:00 the Rangers were trapped. Soon artillery and tanks were firing on them (reported the sergeant major of one battalion) and the German infantry started to close in. "The tanks hurt us the worst," he said. "They caught us in a field and seven moved in, firing with everything they had."

Surrounded, the Rangers scattered and fought individually, but their ammunition was giving out fast. At noon, the radio of one battalion went dead. Minutes later, the sergeant major reported that he was about to destroy his radio because the command post could no longer defend itself. With the last radio dead, contact with the Rangers was cut off. Not another word was heard from them.

The next day the Germans announced that they had captured 900 men, that 100 had been killed and many more wounded.

Against the background of the whole war, the loss of two battalions is not serious; but the loss of these Ranger Battalions will be felt. Carefully chosen after many physical and psychological tests from among many volunteers, and then rigorously trained in commando tactics, the Rangers were specialists in the sort of job they set out to do at Cisterna. In Africa and in Italy they were called upon when troops were needed to move swiftly and silently by night, to strike hard and unexpected blows at the enemy when and where they were least anticipated, and to throw the foe into confusion so that the slower-moving infantry could catch him unprepared.

Like the British Commandos, on whom they were patterned, the Rangers were also specially trained in establishing beachheads on hostile shores, and they were among the first to land in Africa, Sicily, Italy, and finally on the Anzio beachhead.

The target of the Rangers' attack in the landing below Rome was the small coastal town of Nettuno. Before midnight they transshiped from a British transport to landing barges and, as planned, lay off shore awaiting H-hour. They had been thoroughly briefed on the town until, as one Ranger put it, he could pick out the home of the local bootlegger.

Lying cramped on the bottom of the barges that moved slightly on the gentle swells of a calm sea, the moonlight relieving the pitch blackness but not making the night too bright, the Rangers relieved the tension of the dragging minutes with quiet talk.

"Zip Koons told me to watch out on my third, seventh, and thirteenth invasions," said one, who had been awarded the Silver Star and two Purple Hearts. "This is my third."

"What worries me is those 300 yards of shallow water we have to wade through," said another voice in the darkness. "Funny thing about beaches. The boat pulls in until it can't move any more, and then you step out and it is only one foot deep. Then you move farther in and plop—you're over your head. I hit that kind of a false beach in Sicily. Damn near drowned and took my radio equipment with me."

It was now 0150—1:50 a. m. H-hour was 0200. The only sound was the lapping of water against the barges. There was still no air interception nor sign of the enemy.

At 0151 the stillness of the night was shattered by the ear-splitting sound the

Rangers had been expecting. The briefing officers had told them that a British ship would shell the coast at exactly 0151. It was good to know that things were going as planned.

The shelling stopped as suddenly as it started. The night was again silent and black as the barges crept in at three miles an hour toward the beachhead. White marble and stuccoed Italian buildings loomed dimly on the terraced hillside behind the beach.

The Rangers had a fairly accurate idea of what to expect on the shore. The beach was probably mined and behind it was a barrier of "three to seven feet," a sea wall with barbed wire on top. There were also several gun positions, but they were thought not to be occupied. But there was another story that said that seven batteries of artillery had recently been moved into the vicinity. Remembering Salerno, the Rangers thanked God for the relatively flat land, which made the beach difficult to defend.

The barges grated to a stop when still several hundred yards off shore. The men clambered out into knee-deep water and sloshed hurriedly to dry land, sidestepping driftwood that might be mines as they went.

Fortunately the sea wall was only three feet high and the barbed wire was easily cut. Some of the men crossed the road, nicknamed "Hitler Road" in the briefing, and searched the large, resort-type houses.

The surprise was complete. A score of German soldiers were put out of the way by the fast-moving Rangers, who themselves suffered only a handful of casualties. Careful planning, favorable weather, and split-second co-operation had made this a model of combined operations.

The skill and sureness that brought this operation to a successful conclusion in a

Rangers must make lightning stabs behind enemy lines. They'll wear anything that hides them.

In England, Rangers got plenty tough training, learning how to storm enemy shores under fire, with assault craft.

matter of minutes were the results of months of hard, intensive training. Volunteers for certain of our Ranger Battalions were called for in the early spring of 1942, and 700 men from 42 different units of American soldiers stationed in the British Isles were accepted for the new outfit after having undergone searching tests. The authorities wanted to know two things about each prospective Ranger: Did he have exceptional stamina, enough to keep him going throughout a grueling ordeal after most soldiers would have collapsed? And was he ready to kill without compunction or squeamishness?

These Rangers were put through the seven-week commando course in 31 days, during which there was one clear day. Only 520 men survived the daily workout in hand-to-hand, street-to-street, house-to-house fighting, and the frequent marches. The Rangers set a record for a 16-mile march, completing the distance under full pack and with helmets in two hours and 42 minutes—beating the best commando record up to that time.

Training conditions were as close to the real thing as possible. One man relates that he slipped one day scrambling up a muddy bank and his face was spattered with mud churned up by bullets. The commando instructors did not fire over their heads; their marksmanship was so good that they fired around the men and did not hit one.

Volunteers from the Rangers were called for to go on the Dieppe raid. They were the first Americans to land on the French coast, and held their sector for four and a half hours. Some of the liaison men did not get away until more than eleven hours after landing.

Throughout the summer of '42 the Rangers trained in England for the invasion of North Africa. One Battalion went ashore at Arzew, a sleepy village 20 miles east of Oran. Long before dawn on the morning of November 8th they quietly climbed from their transports to landing craft and split into two groups for the landing, half heading for the village and half heading for a point a few miles east of the place to attack on the flank. Approaching the shore in the darkness, one craft grated on what the coxswain thought was the beach. Six men jumped overboard under full pack—into thirty feet of water.

The craft had landed on a rock fifty feet from shore. The coxswain backed his craft off the rock and headed for another point on the beach, and the six Rangers in the water swam to shore.

The other half of the Rangers went ashore

Here the Rangers go into swift action on the Italian coast. Dieppe, Africa and Sicily had prepared them for such daredevil operations.

at Arzew itself at H-hour, 5:45, and quickly overran the lightly defended town. Given the job of capturing a 12-inch coastal gun and its three defending machine gun nests, four men approached the first nest, which surrendered without firing a shot. The two Frenchmen in it greeted the Americans as friends and went with them to the second nest to persuade their comrades not to fire. Though the Americans understood no French, they could follow the meaning of what the Frenchmen were shouting to the men in the second nest. As the latter did not reply, either with words or bullets, the Frenchmen jumped to their feet and ran toward the nest. They were cut down as they ran by a burst of machine gun fire.

But most of the defenders of Arzew, few in numbers and friendly to the invaders, gave in without much opposition. The coastal gun was found to have been made useless by the Germans by the removal of a vital part. After a week in the town the Rangers started down the coast for Algiers.

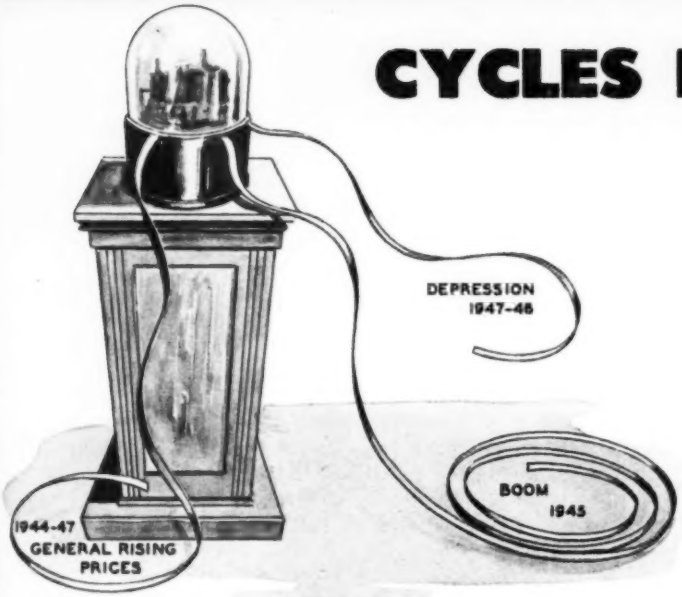
In February, '43, the Rangers participated in the battle of Tunisia that drove Rommel out of Africa. Here they were often called upon to make surprise attacks on the enemy, to throw him into confusion just before a big drive.

One such action took place at Sened Station, between Gafsa and El Guetere. The job for the Rangers was to go on foot fourteen miles behind the enemy lines and destroy an outpost protecting the flank of the vital Kasserine Pass.

About midnight the Rangers crept silently into position and the carefully planned attack went off without a hitch. The Italians, raw troops all of them, were thrown into panic by the suddenness and surprise of the attack and reacted as the Rangers had planned. Everyone of them was killed or captured, but their six German officers escaped in a car. The Rangers had one man killed and eleven wounded, one so badly that he had to be carried. Mindful of the larger enemy force not far away, the Americans started back at once to the French outpost where their trucks would pick them up, carrying their wounded buddy on a shelter half the whole 14 miles.

The Rangers were out in front in the invasion of Sicily on July 10th. They landed at the small town of Gela, which was defended by Italians and Germans and had eight .75's emplaced for protection. The trip to shore in landing barges [*Continued on page* 155]

CYCLES PREDICT



The current year will have a financial set-back period. Prices will then rise generally until about 1947—with a boom in 1945. Watch out for your investments after 1947 and until 1951 has arrived—the danger year.

HERE is a financial picture of the years immediately ahead:

Plan for a set-back in the current year, then a general period of rising prices until 1947, with a boom in 1945. Be prepared for a major depression (post-war?) to start in 1947-48. Thereafter, anticipate a general irregular decline to a bottom around 1951, but make allowances for an intervening boom or recovery period about 1949.

If you *knew* the above dates were correct, you would possess information of incalculable value in planning your financial future.

No one guarantees the above predictions. They are, however, very far from guesswork. They are based upon independent studies of hundreds of cycles—of periodically recurring phenomena—made by many different scientists. Some of the cycles go back for hundreds of years and cover such diverse subjects as sunspots, temperature, rainfall, wholesale and retail prices, and industrial production.

Unanimous agreement among students of cycles is hardly to be expected. The science is still a young one; undoubtedly there are cycles working within cycles, tending to cancel each other when they are out of phase, to intensify effects when they are in harmony. Yet it is striking what general agreement is reached when well-known cycles are projected into the immediate future.

It may be disappointing to some that projection of business cycles do not yet name the weeks or months when stocks and commodities should be bought or sold to show a profit. But cycle scientists do not operate tipster sheets. General cycle projection is quite sufficient for intelligent investors and businessmen. If you know that conditions in 1947 will be somewhat comparable to those of 1929 (as seems likely) you will have ample time to liquidate before the panic comes, and thus avoid being caught with your margins down.

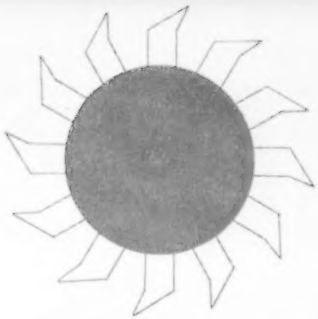
Why should business and other human affairs have rhythmic ups and downs? Possible physiological and psychological effects on man of such cycles as solar radiation have already been explained (see MECHANIX ILLUSTRATED, May). An amazingly detailed study of the relations of sunspot cycles to business conditions, running back through centuries of time, has just been completed by Dr. Raymond H. Wheeler, noted cycle scientist of the University of Kansas, whose work has been summarized in previous articles of this series. Dr. Wheeler's sunspot-business studies are the most thorough thus far attempted, and we are privileged to publish them for the first time.

From 1830 through 1942, Dr. Wheeler's master chart shows 28 downward trends in business and 29 upward swings or booms. This remarkably even balance emphasizes the cyclical nature of economic changes, but it is the *timing* of these changes to which he furnishes a new key. In brief, it is this:

Depressions are associated with times of maximum or minimum sunspots; depressions during sunspot minima are ordinarily brief and of secondary importance—severe major depressions are much more likely to coincide with sunspot maxima.

Booms generally occur during transitions

THE FUTURE



by Donald G. Cooley

What is the business-investment picture for the next ten years? Are cycle scientists in agreement about general cycle projection on this vital subject?

between sunspot maxima and minima, or vice versa.

Two-thirds of the booms and depressions in the past century fit this pattern with bull's-eye accuracy. Perhaps half of the remaining instances are so close to the mark that it is being ultra-conservative to call them exceptions. There are, however, a few definite exceptions which give significant clues to other cycle factors at work—those cycles within cycles which scientists are analyzing in order to make forecasts of the future highly accurate.

The exceptions indicate that depressions are linked with droughts. Depressions also tend to occur with either extremely high or low sunspot numbers (yardstick of sunspot activity). Booms, on the other hand, are identified with times of ample rainfall, and periods when the *rate of change* of solar energy is greatest—that is, when sunspot numbers are changing most rapidly from high to low or low to high. Climatic cycles may thus, at exceptional times, bring a brief boom or recession at an unexpected time.

"Since 1930," says Dr. Wheeler, "there has not been a single sunspot minimum that was not associated with a depression, and only one maximum that was not, namely, 1870. There has been no *transition* in sunspots that has not been associated, during its course, with a boom or upward business trend."

What, then, does this remarkably uniform trend portend for the near future? Sunspots are now in a state of transition toward a maximum, but the center of that transition will not occur until about 1945. Other things being equal, we can reasonably expect 1945, particularly the latter part, to be a boom year.

The next sunspot maximum (predicted on a basis of sunspot cycles which are, however, by no means clocklike in regularity) may be expected in 1947, perhaps 1948. This, then, is a period of which the cycles would warn you to be wary. Dr. Wheeler's chart sets 1947 or 1948 as the time of a probable primary post-war depression. A factor which might make this predicted depression less severe would be ample rainfall during those years, but climatic cycles indicate, on the contrary, that the period will be cold and dry.

Thus we have one bit of scientific evidence that another 1929 may be in the making for 1947. The projected crash, however, may not occur until 1948. A major depression may *begin* with a sunspot maximum but take a little time to get rolling. There was, for instance, a sunspot maximum in 1928, and an actual decline in prosperity during 1927-28, but the great crash in the *market* did not occur until 1929. There were many shrewd operators who read the signs accurately in 1928 and got out of the market months ahead of the window-jumping brigade.

Applying an extreme simplification of Dr. Wheeler's cycle formula to events of the past decade, we should expect booms to cluster around the centers of sunspot transition periods—i.e., 1930, 1935, 1940, in round numbers. We should expect depressions to center around sunspot minima in 1933 and maxima in 1938.

What actually happened? A break in the depression came on time in 1930; 1933 marked the bottom of a secondary depression; improvement, but not full recovery, came with the 1935 transition; there was a secondary crash at maxima in 1938; and the 1941 war prosperity was close to the transition center.

You might well object that this particular decade was chosen to prove the point. It is, however, typical of the cyclical swings of all the other decades since 1830 which Dr. Wheeler has charted. Unfortunately, his studies are so painstakingly detailed that lack of space prevents reproducing them in full.

It is only human to resent implications that we are not absolute masters of our fates. The notion that cycles, beyond our control, to some degree control *us*, offends many. It is natural that we should ask *why?* and *how?* From a realistic point of view, human beings are mechanisms for the conversion of cosmic energy. Your energy ultimately derives not

from the food you eat but from solar energies which make that food supply possible. If solar radiation runs in cycles—as it markedly does—we should expect human beings, like massed receiving sets, to show cyclical responses.

The relation of sunspots and climate to business conditions appears far too uniform to be explained by pure chance. Dr. Wheeler suggests that poor crops are likely during both sunspot maxima and minima. During the former it is too cold and dry, during the latter too warm and dry, with insufficient variation at either extreme. Best conditions for crops and human vitality are likely to occur during sunspot transitions, such as the one we are moving into around 1945.

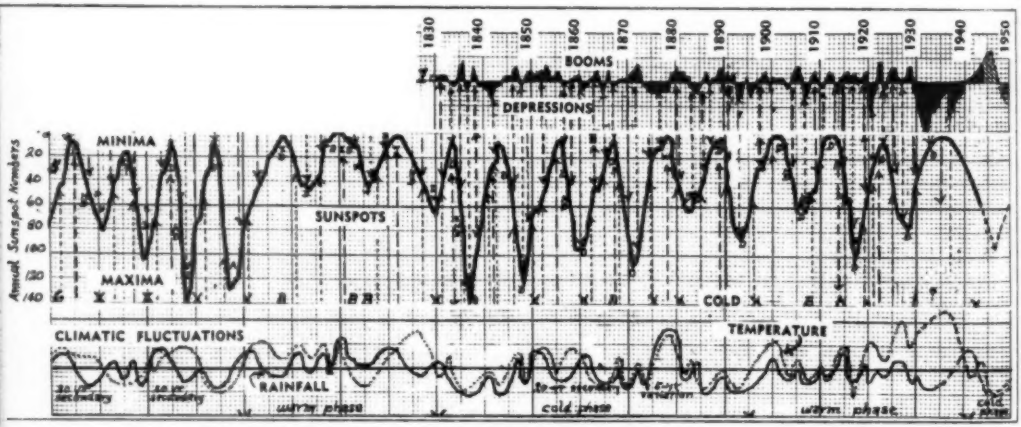
"It is possible that the rate of change of the sun's energy has in itself a stimulating effect which is greatest during sunspot transitions," says Dr. Wheeler. "It is possible that man's system is adjusted to electrical conditions which are insufficient during minima and too severe during maxima, helping to render him lethargic during minima and jittery and unstable during maxima."

If you question that sunspots tell the entire story, you will find Dr. Wheeler in complete agreement.

"After having made an intensive study of these problems for over 12 years, I would be the last person in the world to assume that sunspots or climate or both were the only causes of depressions or booms or wars or any other form of human behavior. But I am convinced that these factors *set the stage* for human achievement, or lack of activity, *through their effect on the energy level.* Should special circumstances motivate man sufficiently he could produce a period of prosperity during times when, otherwise, his energy level would be low (as at sunspot minima and maxima) but he would have to be motivated sufficiently to overcome a handicap imposed upon him by his environment.

"I believe that economic and political causes and motivations are tied into the energy levels of man and thus are integrated with climatic and solar factors. Of this there can be no intelligent denial. Accordingly, when scientists finally solve the problem of long-time solar and climatic forecasting, they will be predicting in numerous ways *future trends in human behavior.*"

What agreement or disagreement is found in cycles which various scientists have made no effort to relate to sunspots? One of the outstanding authorities is Edward R. Dewey, Director of the Foundation For The Study of Cycles. Scores of eminent scientists contribute data on cycles to the Foundation. The organization makes numerous studies for businessmen and corporations, based on conditions in their own industries, and thus puts cycles to the most practical of business uses. Investments running into millions of dollars have been made with the assistance of cycle forecasts and made successfully. However, Director Dewey emphasizes two



Notice how out of proportion to usual depressions was the one in the 1930's (top strip of charts). It may repeat in 1951. Minima and maxima of sunspots (center strip) correspond with bad business periods. An average number of sunspots means good times in the financial world. Ample rainfall would alleviate to a degree the sunspot maxima and depression period around 1947, but it'll be dry.

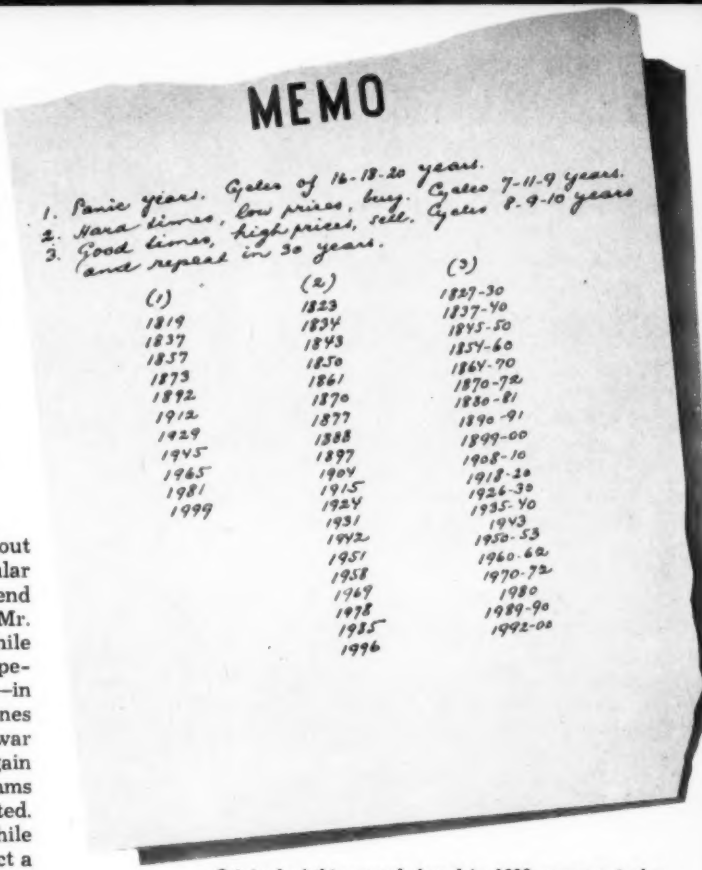
things most strongly: One, that cycles, to be depended upon, must have repeated themselves so often and so regularly that they cannot reasonably be the result of chance; and two, that the cycles in each series of figures in which one is interested must be determined separately. What is true for one business is often not true for another.

"In my own personal affairs I am counting (barring war distortion) on the probability of good business until about 1947, and then an irregular falling off until about the end of 1951 or 1952," says Mr. Dewey. He finds that while wars do upset cycles—especially the longer swings—in the same way that hurricanes upset the tides, after the war the cycles pick right up again and go on, and short rhythms often are entirely unaffected.

You will note that, while Mr. Dewey does not predict a major depression in 1947, he marks it as the probable end of a period of good business, and his forecast of falling prices until 1951-52 is in good agreement with Dr. Wheeler. The projections are made, moreover, from cycles which there has been no particular effort to tie into solar rhythms.

For instance, Mr. Dewey cites a major rhythm in average wholesale prices in the U. S., the idealized pattern of which has its peaks 54 years apart, showing the same characteristics as British wheat prices running as far back as seven hundred years. The last peak of this pattern came about 1925; the next low (half of the 54-year swing) should thus come somewhere near 1951-52.

The major 54-year rhythm breaks up into pronounced shorter swings about nine years in length—six of them, you will see, to the longer cycle. Significantly enough, many businesses show a combination of nine- and eighteen-year rhythms, "both of which are due for lows about nine years from now," said Mr. Dewey, speaking in 1943. This would coincide with a 1952 depression. On the basis of


MEMO

1. Panic years. Cycles of 16-18-20 years.
2. Hard times, low prices, buy. Cycles 7-11-9 years.
3. Good times, high prices, sell. Cycles 8-9-10 years
and repeat in 30 years.

(1)	(2)	(3)
1819	1823	1827-30
1837	1834	1837-40
1857	1843	1845-50
1873	1850	1854-60
1892	1861	1864-70
1912	1870	1870-72
1929	1877	1880-81
1945	1888	1890-91
1965	1897	1899-00
1981	1904	1908-10
1999	1915	1918-20
	1924	1926-30
	1931	1935-40
	1942	1943
	1951	1950-53
	1958	1960-62
	1969	1970-72
	1978	1980
	1985	1989-90
	1996	1992-00

Original of this record, found in 1902, came out of a 40-year-old desk of the Overholt Distilling Co. It is reputedly the basis for the Mellon fortune. Mr. O. W. Kennedy, U. S. Steel director, found it in the desk.

these and other cycles, Mr. Dewey feels that —always barring war distortion—we can expect rising prices until about 1946, then four or five years of decline.

He goes further, pointing out that the recurrence of ups and downs at intervals of *about 41 months* seems to be basic in our economy.

"Out of more than 500 different kinds of economic series that have been analyzed by the Foundation For The Study of Cycles and others who have worked in this field, I would judge that *more than half* show a tendency toward rhythmic fluctuations of something like this interval," he tells us. A basic 40- or 41-month wave is present for common stock prices as a whole, for dozens of individual securities, iron and steel production, many commodity prices, and sales figures of many corporations. Surprisingly, this interval corresponds with [*Continued on page* 149]

A prize indeed! It's that latest of Nazi fighters, the trim Messerschmitt 109G.

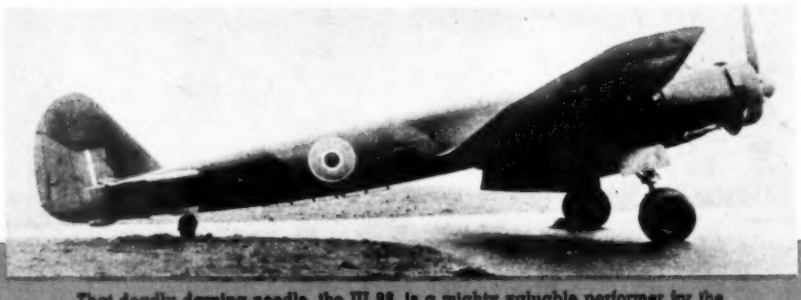
NAZI FLYING CIRCUS

The Focke-Wulf 190 needs no introduction. Our Thunderbolt is closest to its design.

CRACK RAF pilots are putting on one of the weirdest aerial shows ever seen in the air over England. The English have seen many a Nazi plane, but never such a complete enemy flying circus in operation at one time. These are the best and latest Luftwaffe ships that have been shot down in Britain. They are flown so that the Air Ministry knows all about them operationally.

An RAF crew is giving a new Heinkel 129 twin engine fighter-bomber the onceover.

A Messerschmitt 110 twin engined medium bomber has told its story to these flyers.



That deadly darning needle, the JU 88, is a mighty valuable performer for the English now. Her secrets, and there were a few, are on RAF drawing boards.

Chemical warfare developed our new and very efficient 4.2 inch mortar. This weapon would be a honey of a poison gas hurler should we be forced to retaliate against Axis tactics.

WHY NOT POISON GAS?

by Willy Ley

Do you think that poison gas is deadly and efficient?
Will the enemy resort to it soon or as a dying effort?

IT IS perhaps significant that the first report about the use of poison gas in the present war originated with the Axis. When three British cruisers caught the German pocket battleship *Graf Spee* off the South American coast and shot it up so badly that Hitler had it scuttled rather than make it fight again, the German Ministry of Propaganda supplied the commander of the *Graf Spee* with the alibi of poison gas.

The British cruisers, Dr. Goebbels' busy hirelings alleged quickly, had won their victory by firing mustard gas shells at the German ship. Of course the whole story was nothing but a propaganda lie concocted in Berlin, as publication of a series of documents and reports relating to the battle quickly proved. The real question is why the Nazis invented that lie.

Did they do it solely to sugar-coat the fact that one of their vaunted warships had lost against three definitely inferior (but faster) cruisers? Did they try to stir up public opinion against the British for using such a "hateful" weapon? Or did they try to produce an advance alibi for some gas warfare

of their own? There is no definite answer to these questions, but the probable answer is that the Nazi Propaganda Ministry played on all three strings, listening carefully to see which one would find the strongest echo, which would then be the one to exploit in future propaganda campaigns.

The trouble was that the whole lie was too obvious. The use of mustard gas in naval shells is not only unlikely but simply absurd as will become apparent later on. And everybody who had the slightest knowledge of naval warfare discovered the lie at once, and a lie recognized as one is not any too good for propaganda.

But there exist other reports about the use of poison gas from other sources and they are more credible. The Chinese Government reported that some eight hundred cases of Japanese use of poison gas (mostly mustard) on Chinese territory had been brought to its attention, some eighty cases well documented. And after about one year of war the Russian Government charged the Germans with the use of poison gas, apparently an experimental attempt.

On the whole, however, poison gas has been conspicuous mainly by its absence and there are quite a number of good reasons for it. The two most important are that both sides can play the same melody (a warning broadcast by Churchill at one occasion, when the problem of gas warfare seemed imminent)—and that gas is not likely to be effective enough for the present methods of warfare.

But before we go into these questions we have to delve into the past history of gas warfare. It is one of the most deep-rooted popular misconceptions that poison gas war was a great novelty when the Germans started it in 1915 and that the various gases employed were all new inventions, hurriedly made under the stress of war. The latter idea implies, of course, that chemists must have found much more powerful gases in the meantime, so powerful that the Staffs are afraid to use them. It is the latter thought which has been deliberately harped upon by ignorant pacifists ever since 1918.

The novelty of gas warfare in 1915 consisted mainly of the fact that somebody actually used it. The weapon itself had been under theoretical discussion for many centuries. One of the most elaborate old discussions of the theme can be found in a book written around the middle of the seventeenth century by one Kasimir Siemienowicz, then Commander-in-Chief of the Polish Army. Siemienowicz came to the conclusion that "poisonous smokes" should be used only against Turks and Tartars, while other smokes that only irritate could be used against Christians as well.

The substances used during World War I were, with two or three exceptions, as "novel" as the idea itself. Chlorine gas, the first gas used by the Germans, had been discovered in 1774 by Carl Wilhelm Scheele and had a large use in industrial undertakings. Phosgene gas had been made for the first time by Sir Humphrey Davy in 1811 and the thick liquid known as mustard gas had been made by Niemann in 1856, the solid substance called diphenyl-chloroarsine had been made in 1881 and the liquid chloropicrin by Stenhouse in 1848.

The German six-barreled Nebelwerfer was developed as a chemical weapon. Here it's mounted on an armored car.

In short, it was not at all a question of "inventing" poison gases, it was a question of selecting known poisonous substances for use in the field. The requirements which such a substance has to meet are severe and multitudinous. It should be odorless and invisible, it should act quickly, preferably through the skin as well as through the lungs. It *must* be heavier than air and it should be persistent in one case and non-persistent in another. At the same time it should be chemically stable so that it can be stored

without deteriorating. It must stand the shock of explosions without losing its chemical structure. It must consist of cheap and abundant raw materials, its mass manufacture must not be complicated. It must not eat through containers, but should go through gas masks and clothing. And so on, and so on, and so on.

It is said that 100,000 substances were tested theoretically, 1,000 of them were tested actually. Some thirty reached the battlefield and eighty per cent of them did not perform in the field, although they had performed on the testing ground. In the end two were left, phosgene and mustard gas, neither of them fulfilling all the demands, and both being representative of two groups which the Germans called *Grunkreuz* (Green Cross) and *Gelbkreuz* (Yellow Cross), from the markings on the shells. In English "Green Cross" is called a *suffocant* or lung irritant, while "Yellow Cross" is called a *vesicant* or blisterer.

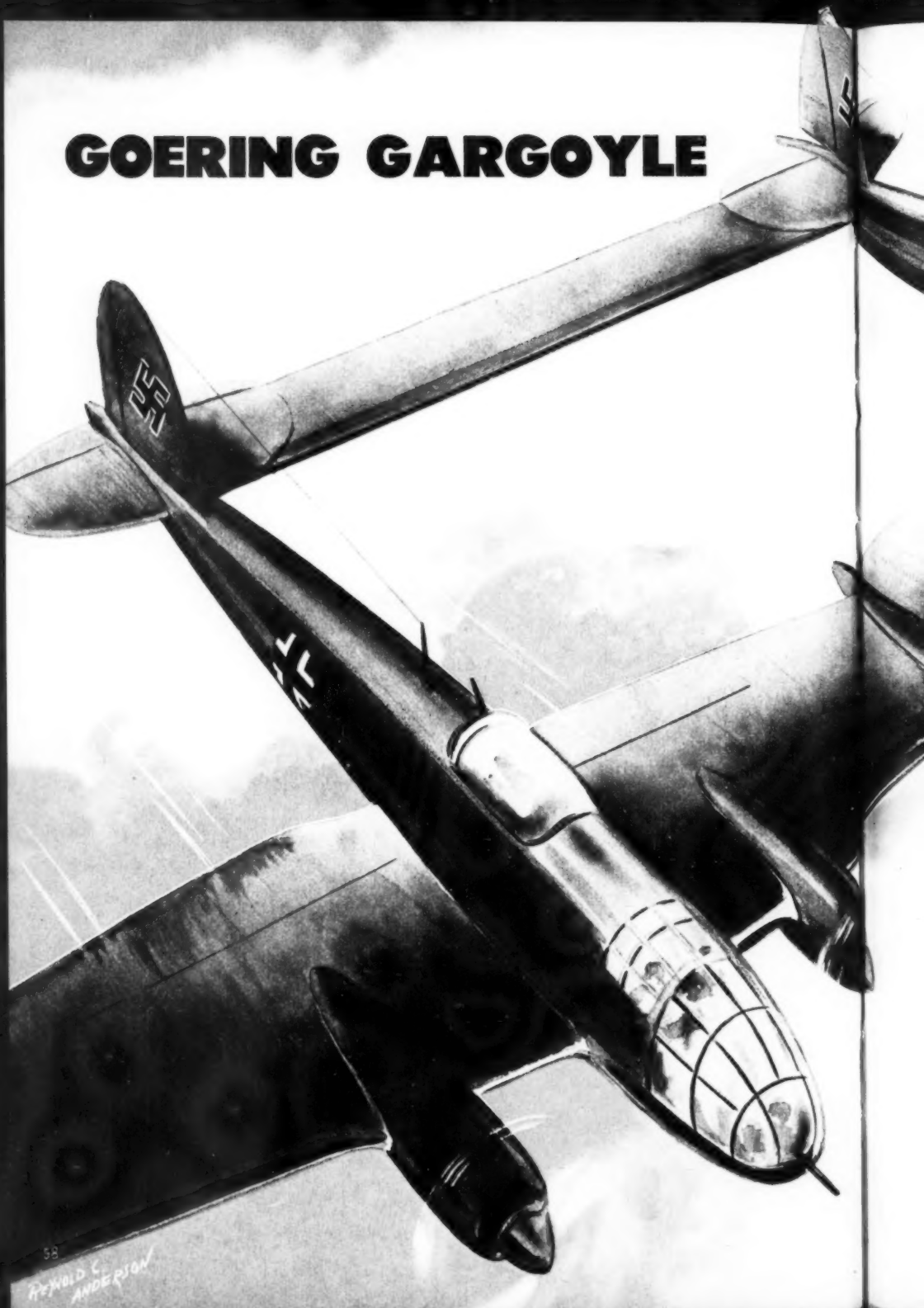
Since World War I a new family of gases has been added, the so-called nitrogen mustards. Nothing much has been released about them, but the name in itself shows that they belong to the group of the blisterers, presumably with about the same characteristics as the known *vesicants*.

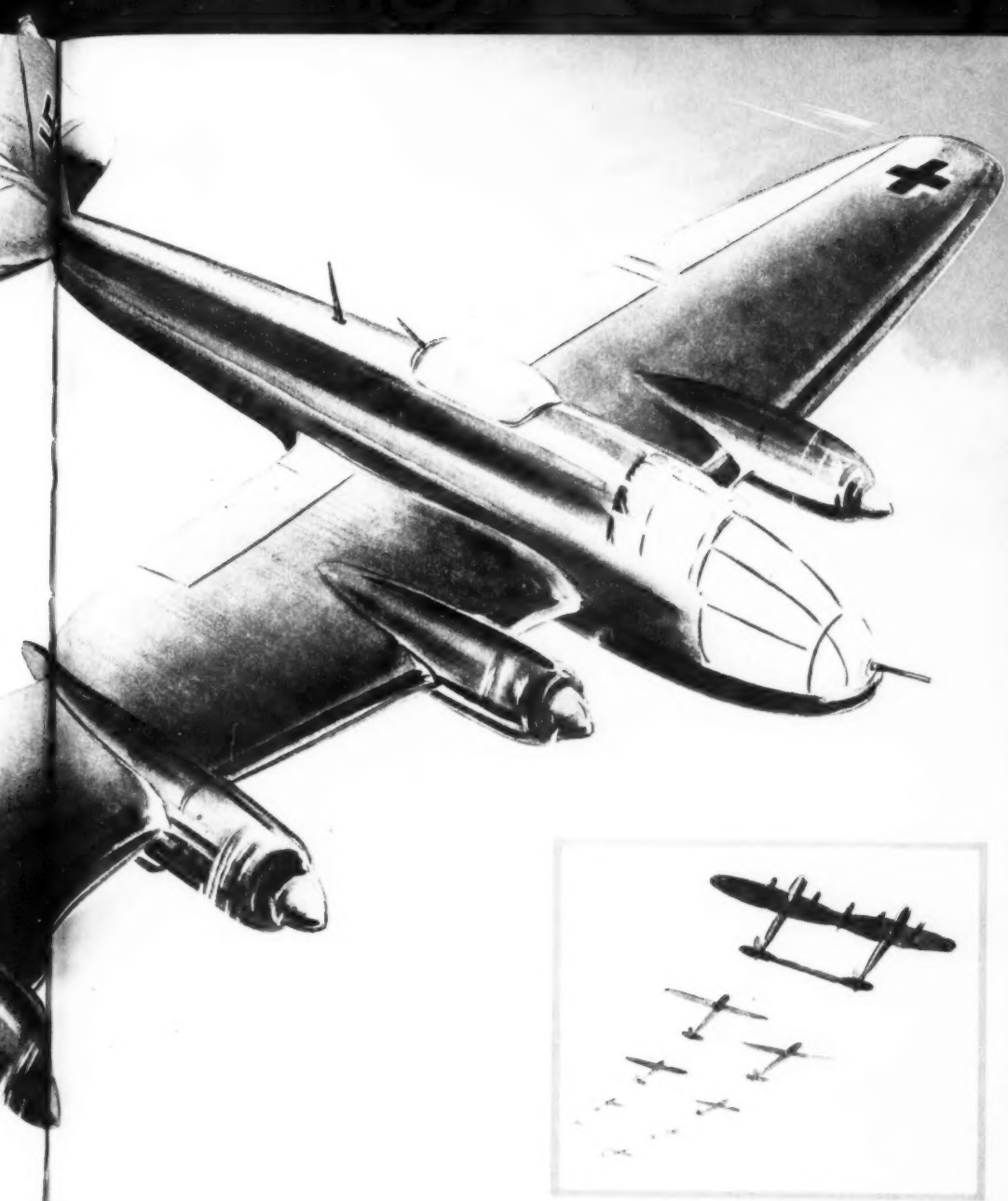
We'll now look at the actions of a typical suffocant and a typical vesicant, phosgene and mustard gas. Phosgene is actually a gas. Its most important failure as regards the list of demands quoted is that it forms visible mists when the air is moist. When its breathed in the victim usually does not notice anything at first. Very often he carries on with his duties for an hour or two to collapse suddenly and possibly die from pulmonary edema. A well-fitting gas mask protects its wearer and if the presence of the gas is known it is most of the time possible to avoid being poisoned, even without a mask. The purpose of phosgene, however, is to kill and phosgene does kill. But, fortunately, it does not last long in the open; it is quickly dispersed by even a light wind and is destroyed by moisture.

If used in the open against trained soldiers its main value consists in annoying the enemy by forcing him to wear masks. But the gas-shooting force has to wear masks too. The main drawbacks in the field are usually called "weather." You can lob trench mortar projectiles and artillery shells in any weather, in rain and sunshine, [*Continued on page* 151]

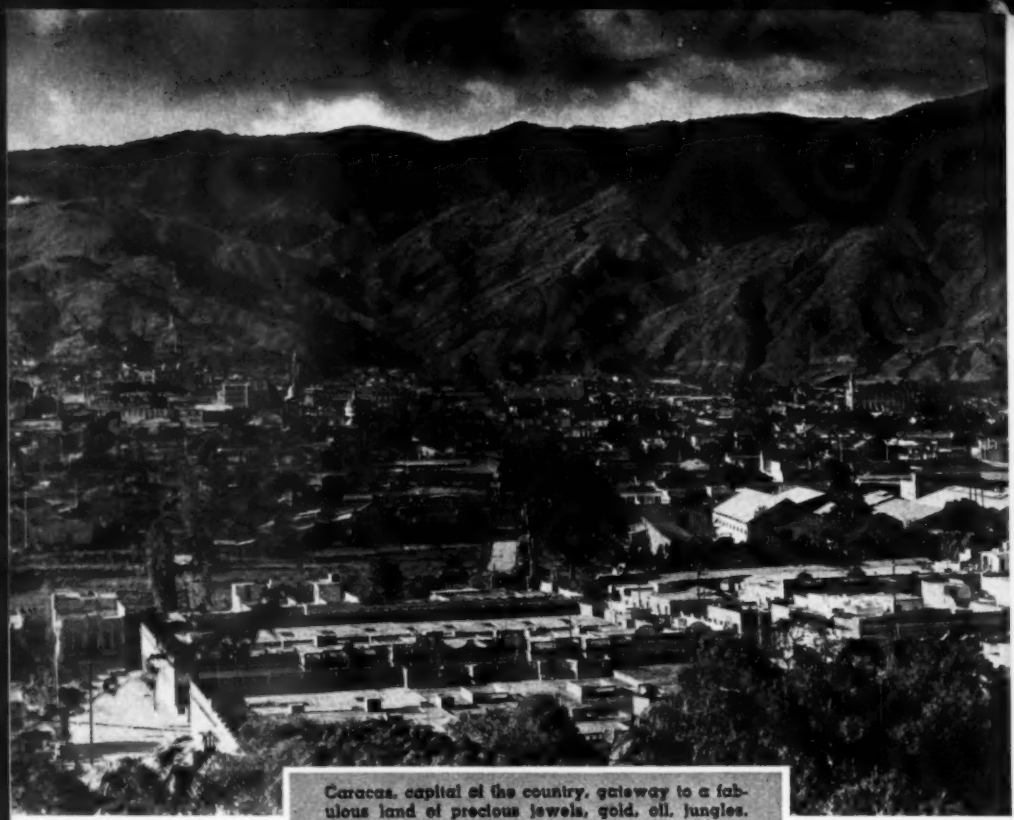
The Nazi multibarreled gun firing. While the range is limited, the effect of six shells hitting a definite area almost simultaneously could be devastating with right weather holding.

GOERING GARGOYLE





ONE afternoon last March an American airman saw a strange sight over France. It was an aerial Siamese Twin—two Heinkel 111's, twin-engined bombers, joined at their wing-tips, with a fifth engine mounted between them. He shot the gargoyle down, winged back to his base and reported. Intelligence officers figured out that the monster was not the German version of our fork-tailed P-38, but merely a glider tow-plane. Hitler's aviation industry must be in a bad way if it has to resort to such last-ditch makeshift devices.



Caracas, capital of the country, gateway to a fabulous land of precious jewels, gold, oil, jungles.

CONTINENT OF TOMORROW

NO. 8: VENEZUELA

by

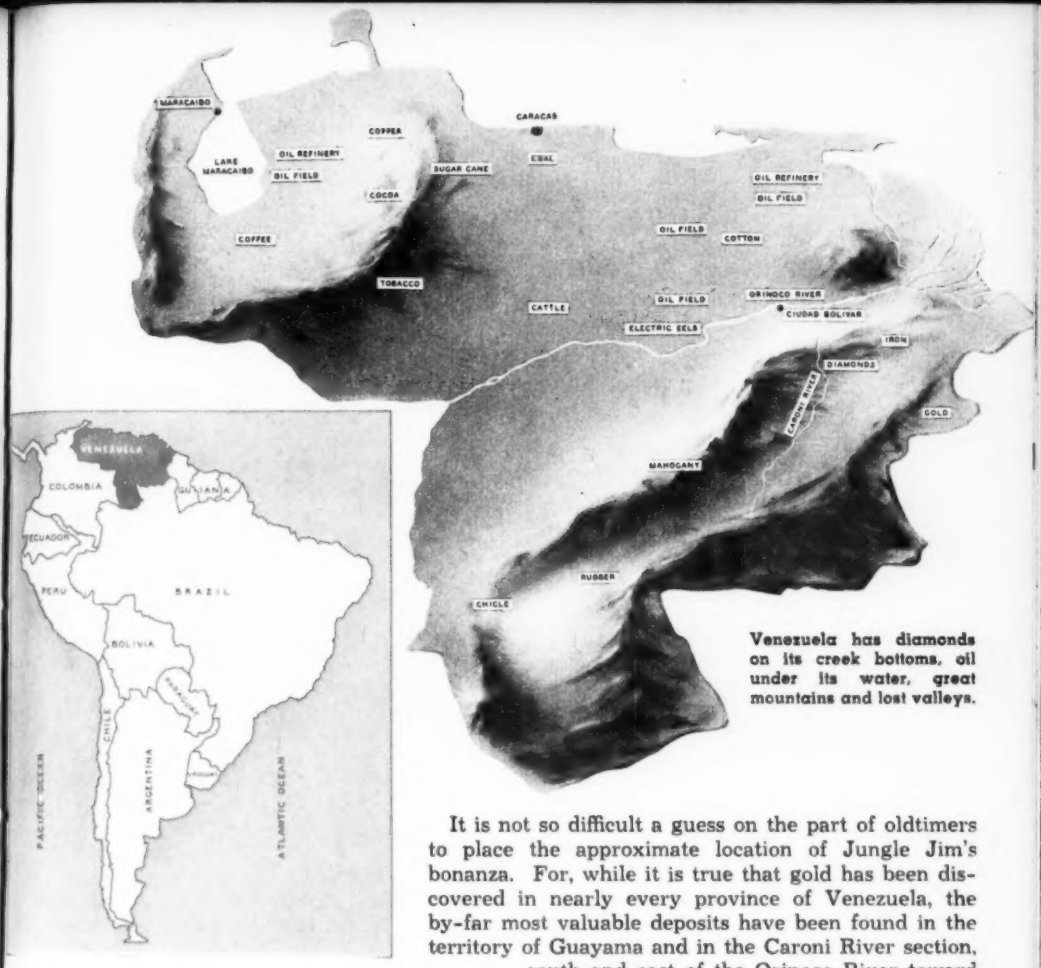
Henry Albert Phillips

Eighth in a series of articles taking you country by country through South America.

GETTING right down to brass tacks, Venezuela is the orneriest nation on earth.

Two circumstances have helped to make her what she is today. The first was a half century under the rule of the cruelest of tyrant dictators. The second was the country's exploitation by foreign oil companies—mostly American—which has brought its people more money than they know what to do with, and led a widespread abandonment of all the other rich blessings that nature has heaped upon them.

Such a state of affairs leads to both good news and bad—mostly good, however—for all the fellows who intend to go marching down Venezuela way, after the big fight. Take the case of the now famous "Jungle Jim," who was just another one of those American seekers after the South American El Dorado. His real name is Jimmy Angel, and he happened to be an air pilot.



Venezuela has diamonds on its creek bottoms, oil under its water, great mountains and lost valleys.

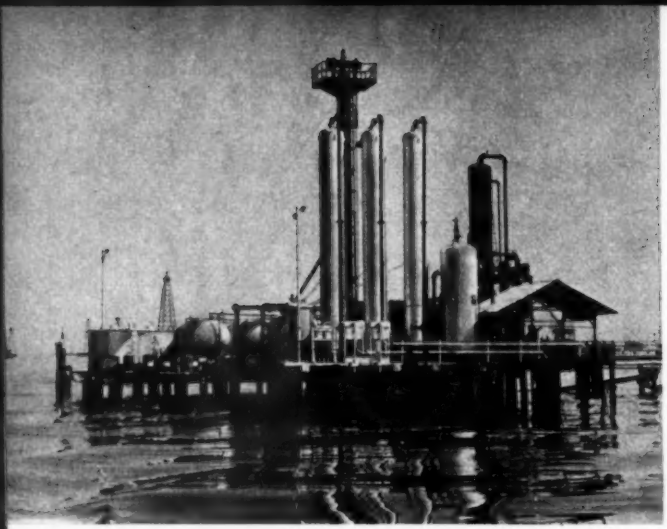
On one of his dare-devil flights, Jungle Jim—as you may have read in the papers—discovered the highest waterfalls in the world, which you'll find in your geography today under the name of "Angel Falls." Jimmy went skimming and snooping all over that big lumbering wilderness called Venezuela; it's nearly one-eighth the size of our United States with only as many people as Chicago, and nine-tenths of it as inviting as the Dismal Swamp. Well, one day he came down in what he believes was the greatest gold and diamond field in the world. He went back to Caracas jubilant. But he was never able to find his gold and diamond mines again! All Jimmy can say for certain is that they lie somewhere a little less than a thousand miles south of Caracas, the capital.

Somebody is going to rediscover those "King Solomon" mines again someday.

It is not so difficult a guess on the part of oldtimers to place the approximate location of Jungle Jim's bonanza. For, while it is true that gold has been discovered in nearly every province of Venezuela, the by-far most valuable deposits have been found in the territory of Guayama and in the Caroni River section, south and east of the Orinoco River toward the borders of British Guiana. Angel Falls lie in this general direction too.

A glance at the map shows the Caroni River flowing almost due southward from the mother stream, the Orinoco, for a distance of about 300 miles to the borders of Brazil after leaving Ciudad Bolivar, the metropolis of the deep south. The river penetrates what is undoubtedly as obscure a terrain as there is to be found anywhere else on the globe. On the east, British Guiana shuts off the Atlantic Ocean. Due westward are dense forests of mahogany. High mountains, deep tropical valleys edged with dense jungle, a network of swamps enclose a region of rivers, for the most part unexplored and inhabited only by savage Indians, reptiles and wild beasts. Herein lie incredibly rich deposits of gold, silver and diamonds.

This Caroni River section, the name by



At Maracaibo natural gasoline comes out of this well. The lake is this world's richest oil field, a dream for any Yankee engineer-adventurer.

which it is generally known, should be the goal of the true Venezuelan fortune seeker. There yellow gold is king, and all talk and smell of the petroleum black gold of the north has long since vanished from the scene and atmosphere. Where hundreds of millions of dollars have been spent in discovering and producing oil in the populous north, scarcely the same number of thousands of dollars have been expended in unearthing countless millions in gold in this primitive southland.

At El Callao, the new gold fields of Venezuela, Ltd., an English mining company averages ten million dollars worth of gold a year. A French outfit called Compania Franceca de la Mocupia, averages considerably less. Occasionally they find diamonds which add considerably to the profits of their venture. If the records of the proceeds of approximately twenty thousand "panners" were honestly recorded, however, they would reveal a different story. As a matter of fact, the Caroni region, with its hundreds of tributary streams, with no intercommunications between the few civilized inhabitants, still remains largely a legendary country. The larger rivers are swift and treacherous and tunnel through impenetrable jungle into which many miners are drawn and forever lost. A proper exploitation of the gold and diamond region, with modern processing of low-grade ore and efficient transportation, would yield gold alone estimated at fifty millions a year, or about the same high level that was reached during the famous California gold rush in 1856. For a comparatively short time great interest was shown in this "South American Klondike." It simmered down completely following the breaking out of World War II. Today, it has settled back again to become the "workings" of a small army of "panners" who make what they call a good "living" washing gold along the river banks.

It is the strangest mining field of any consequence in the world. Out there along the banks of a deep jungle stream perhaps hundreds of miles from civilization, you will find a couple of men working like beavers in a steaming atmosphere that would boil a lobster, "panning" gold. All they wear is a thin cotton shirt, white pantaloons like drawers tied at the ankle, with native straw sandals on their feet and a broad-brimmed straw hat on their head. First, they clear away the topsoil and vegetation. Then the digging of the "pit" is begun. It's sometimes ten feet in depth before they reach the slimy blue mud that marks the end of the pay gravel. Every *batea*, or wooden shovel, full of earth is carefully washed in the search for grains of gold.

Gold has been known in the Caroni area for a century or more. It was not until 1912, however, that diamonds were discovered, through one of those "throw-ups" of nature, like the vomitings of volcanoes that often disgorged cascades of minerals and precious stones. In 1912 the countryside suffered one of the worst droughts in the memory of man. Riverbeds reached an all-time low and in their famished state showed not only their ribs but their very guts. Their dried-up bowels were studded with diamonds and other precious stones! Natives and resident miners reaped a rich harvest that year.

But they had to wait twelve years before another similar fortune dropped into their lazy hands without an effort. Again, in 1926, came the driest season ever known throughout Venezuela. Diamonds galore protruded from the dried-up river bottoms. The fame of the Caroni diamond field spread. Diamond merchants from all the world's rich capitals sent their buyers to Venezuela—or did, before the War—which gives some indication of just how important it had become. One little jungle village, called Paviche, collected a fabulous harvest [*Continued on page* 160]

BRITAIN'S BACK-ROOM BOYS

They never let the sun set on the empire's flood of inventions, brainy or zaney.

In 1919 a War Office clerk found a 1911 plan for a tank with "the man's mad" written as a comment.

But in this war Britain's Invention Bureau gives a hearing to the genius, the joker and the goon.

SHORTLY after the last Armistice, a clerk in the British War Office, cleaning out a well-stuffed desk, unearthed a dust covered set of blueprints. It was a thoroughly detailed design for a tank and had been submitted in 1911 by an unknown Nottingham plumber. Written in red ink across the drawing was the terse, official comment:

"The man's mad!"

In this war, however, the British are bending over backward to avoid repetition of the Colonel Blimp brush-off for aspiring inventive genius.

Today, anyone with an idea, no matter how fantastic or Rube Goldbergish it may seem, can get a hearing for his brainchild by the best engineering minds in Great Britain—the Inventions Bureau.

Since the beginning of the war, this bureau, a group of practical engineers—known to the irreverent daily press as "The Back Room Boys"—has examined more than 75,000 ideas on how to beat Hitler.

These ideas have poured in from every corner of the Empire. They have been submitted by street-cleaners, school teachers, bookmakers, bootblacks, members-of-parliament, factory workers, 12-year-old boys and ninety-year-old women.

No matter what the source or how zany the idea may seem each suggestion is scanned closely. For the bureau operates on the principle that even in the wackiest of brainstorms there may be the germ of a real idea.

Each month, after this preliminary screening, the Back Room Boys prepare a list of ideas suitable for closer inspection by specialists of Aircraft Production, the War Office, the Admiralty, Home Security and the Department of Scientific and Industrial Research.

Sometimes, the inventor is called in for

further consultation with department specialists. Often, for security reasons, the discoverer of a really brilliant idea cannot be notified of his plan's success until the war is over.

In fact, when peace comes, it may be disclosed that some of Britain's most effective "secret weapons" were contributed by this vast army of unknowns. At present, each worthwhile idea is kept on file at the bureau. Awards will be made by a special Royal Commission when the inventions can be taken off the secret list.

The bureau's open-ear policy of listening to all-comers has, of course, put some rather fantastic ideas into the records.

Shortly after Dunkirk, when the parachutists' scare was at its height, hundreds of suggestions for dealing with the aerial invaders flooded the bureau. A Londoner dreamed up this one:

"A great net, similar to a fish net, will be stretched over the city. When a German parachutist drops into the net, a bell will ring, calling the police."

An extremely practical farmer, however, had a more realistic approach. His suggestion, complete with drawings, called for the simple attachment of a bayonet to the right foot.

"I scarcely believe," he wrote, "it will be at all necessary for me to draw a blueprint showing exactly where this is to be applied to person of descending parachutist."

The Blitz, too, brought its share of screwball contraptions. One was a highly elaborate drawing for an anti-aircraft shell to be filled with "sticky stuff such as tar." Upon exploding, said the inventor, "the sticky stuff will stick to the windshields of the bombers thereby making it impossible for the pilot to see."

Another gentleman wanted the RAF to equip aircraft with grappling hooks which would scoop up parachute-floated land mines and carry them back to Germany before they had a chance to reach the earth.

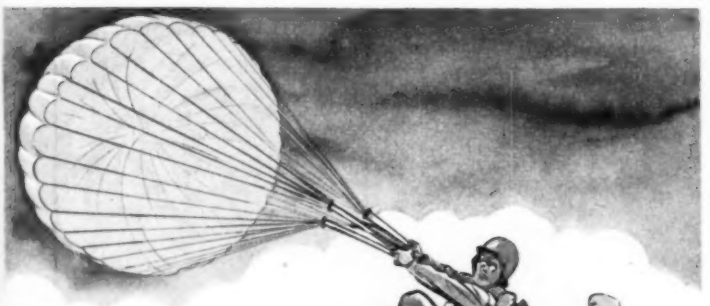
Both of these were topped for sheer zaniness, however, by the lady who proposed the erection of North and South magnetic poles in the East and West of England. "These poles," she said cheerfully, "will upset the compasses of enemy aircraft and confuse the pilots, terribly."

Cooperation of the animal kingdom was suggested more than once. A retired circus hand submitted an elaborate plan for the employment of sea lions in clearance of mine fields. The lions, he said, could easily be trained to head in the right direction by firing shots over their heads. "If this suggestion is accepted," he wrote, "I will get the seals for you and train them myself."

Another animal enthusiast wanted to wrap incendiary leaves around live rats. The rats would then be fitted with individual muzzles containing small quantities of gunpowder and matches. "Then," he said, "we will take the rats and set them loose along the enemy docks. Sneaking aboard the Nazi ships, the rats will chew on the matches and blow up the works."

One mysterious character, who preferred to remain anonymous after the fashion of Sherlock Holmes' correspondents, sent in a self-styled "radio-acid bomb." With the drawing was a scrawled note: "If you wish to communicate with us leave a message under the pile of stones on the corner of Burmead Road and Grove Road End, Hitchin."

Another inventor suggested that troops in the desert be equipped with



An irate but practical farmer suggested the above method of dealing with enemy paratroopers. Necessary material—one bayonet—one piece of cord.

umbrellas painted on the inside with a replica of the constellations. These would be used as sunshades by day and guides by night.

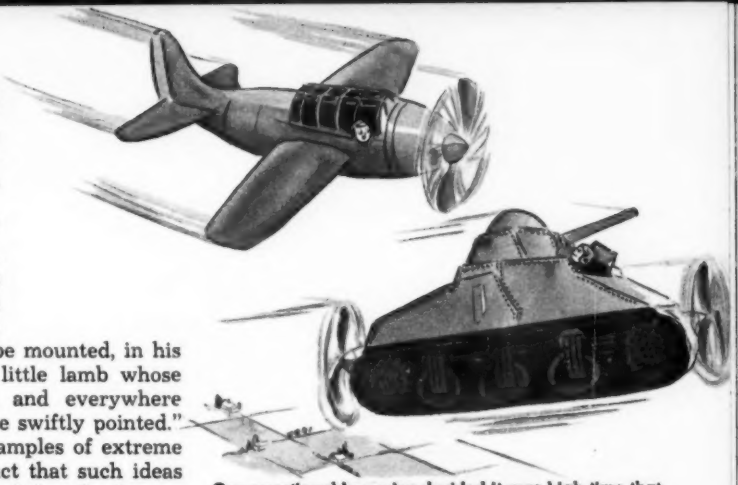
"Flying" and "jumping" tanks are great favorites. One questionable genius mailed in plans for a flying-tank which had a propeller at both ends to be mounted, in his own words, like "Mary's little lamb whose nose was double-jointed, and everywhere Mary went, the lamb's nose swiftly pointed."

These, of course, are examples of extreme zaniness. But the mere fact that such ideas are listened to at all is proof that the Inventions Bureau and the Back Room Boys are not overlooking a single bet.

There will be no dust-covered plans found in War Office cubby holes when this war ends.

On this side of the Atlantic American inventors, would-be inventors and frequently crack-pots, were given an ace opportunity for explaining their ideas to the National Inventions Council that was established some sixteen months before Pearl Harbor. This Council channels constructive ideas out to the branches of the military which might be able to put them into successful operation. Over 200,000 ideas have reached the Council, a considerable number have been put in use by the armed forces—and, of course, a great many more are in the works. These ideas represent just about a perfect cross section of our nation and the largest percentage of them come from men and women who expect nothing in return for their labors. As the policy is to have the enemy feel the consequences of these various inventions before the public here knows what they are, the brilliance, the efficiency and the laughs will come out only after the war. It is a rare credit in the Council's favor that more than 150 of the country's best engineers, scientists, ideamen are on its special committees. These experts could not be paid enough for the work they do. And yet they donate their services to this organization for nothing.

There seems to be a marvelous stimulus to invention because an Austrian paper hanger and a feudal emperor with his medieval cohorts developed an appetite for devouring the civilized world. That school teachers, bank clerks, eminent scientists, farmers, lawyers, mechanics, felons, financiers—that all of them have turned to schemes of destruction of



One questionable genius decided it was high time that tanks flew. He sent in blueprints for a double ender.

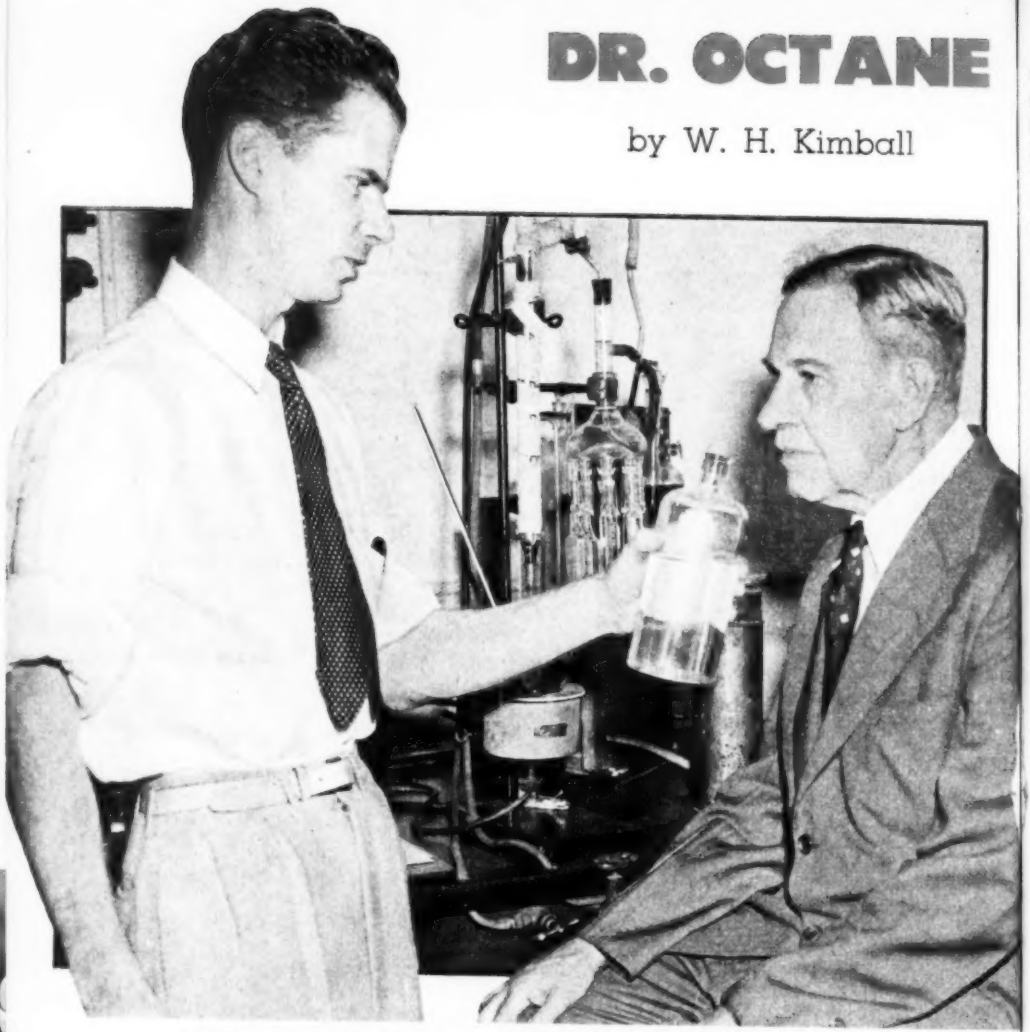
sound or unsound principles, is a gigantic reflex in action not even closely estimated by the expert boys in the back room.

It's not heresay that our technical experts on the Council were capable of appreciating the chemical and ballistic genius of this nation of scientific tinkerers, crack shots and imaginative gentry and dametry. What American comedy will eventually come out of the polite rejections by the Council will be no more than the usual hearty and healthy British or American laugh over people who have tried hard, meant well—but went overboard through enthusiasm over the will to be helpful.

Another goonius, playing mysterious, sent in a "radioacid bomb," gave directions how to reply to his idea.

DR. OCTANE

by W. H. Kimball



Dr. Vladimir Ipatieff (right) and his young assistant, Dr. Vladimir Haensel, with a bottle of triptane which they developed to cost one dollar a gallon instead of 50.

The Russian chemical wizard who came to America and stayed to create perfect gasoline and triptane, the super synthetic fuel to beat the Axis.

NOT long ago, a prominent scientist made a remark at a cocktail party in New York which caused a considerable ripple in the scientific world.

"We are sending the Russians something like a billion dollars a year in lend-lease goods," he commented to a group of his colleagues. "But if they never repay us one cent, we will still be indebted to them for hundreds of years to come."

"Why?" he was asked.

"Because we got Ipatieff from them," was the reply.

His group of acquaintances looked at him blankly. None of them had ever heard the name before.

There were perhaps a hundred guests at the cocktail party, which was a gathering sponsored by one of America's great manufacturing companies in the field of science. Most of the guests were men well acquainted with the latest developments in research. A quick poll of the guests disclosed that only three of them were acquainted with the strange Russian name of Ipatieff.

Largely as a result of that chance conversational remark, Vladimir Nikolaevich Ipatieff has recently received a measure of public recognition in America.

Yet Ipatieff has received enough decorations for his accomplishments in science to assure the reputations of a dozen ordinary men. And he has given to America what is without any doubt the greatest "secret weapon" that any nation can possess.

Vladimir Ipatieff has given America a fluid called triptane—a name almost as little known as that of Ipatieff, himself.

Triptane is a fluid chemically similar to gasoline which, experts say, will give our fighting planes a "kick" vastly greater than any enemy planes can possess. The "power" of gasoline is measured in terms of octanes. Theoretically, 100 octane gasoline should be chemically perfect gasoline. Actually, research in our petroleum laboratories has made the term "100 octane" obsolete. We have long been producing gasolines superior to the "ideal" fuel.

But consider this remarkable fact: Professor Ipatieff's triptane will have a superiority of perhaps 50 octanes over anything the enemy can produce.

Dr. Gustav Egloff, former president of the American Institute of Chemists, said of triptane, "With triptane in their tanks, our fliers will be able to shoot down the enemy's fliers as if they were roosting pigeons."

When the post-war possibilities of triptane are taken into consideration, it is easy to see that the New York scientist was not exaggerating when he said we will be indebted to Russia for hundreds of years because we got Ipatieff from Russia.

Ipatieff, however, did not come to us as a gift from Russia. Russia, knowing his worth, tried in every way possible to get Ipatieff away from us, as a matter of fact. Premier Josef Stalin, personally, exerted great pressure to force Ipatieff to return to his native land. On one occasion, Stalin sent the Russian ambassador, Alexander Troyanovsky, on a personal mission to attempt to persuade Ipatieff to return to Moscow.

When that attempt failed, Stalin ordered Russian scientists to snub Ipatieff and later expelled Ipatieff from membership in the Russian Academy of Sciences. When Ipatieff was still adamant, Stalin revoked his Russian citizenship. And, in a final attempt to intimidate him, the Russians brought pressure to bear so that Ipatieff's own son, a professor at the University of Leningrad, publicly denounced his father as an "enemy of the proletariat."

Vlaidmir Ipatieff is now 76 years old. He is six feet and half an inch tall and has bulky shoulders. He is somewhat shy, yet has the ready self-assurance of a man with a free and brilliant mind.

When he took out his American citizenship papers and was being examined as to his qualifications to become a citizen, the Federal Court judge asked him, "Do you attend any church?"

"Yes," Ipatieff replied.

"What church?" the judge asked.

"Any church," said Ipatieff.

"What do you mean?"

"I said I attend any church," Ipatieff insisted. "This is a free country, isn't it?"

His examination ended without further questions as to his qualifications to become a citizen.

Ipatieff comes from a renowned Russian family. The first of the Romanov Czars, Michael, took his crown at a ceremony on the estate of the Ipatieff family near Moscow. Vladimir was the son of a famous architect who built many of Moscow's best known structures. He was born amid the splendid trappings of pre-Revolution Russian Court life and, like most sons of wealthy families, was brought up and educated to serve as a decorative officer in the Czar's army.

Vladimir, however, had a restless mind and early in his life he became enamoured of science. At the Czar's Military Academy, he paid little attention to the lessons in military subjects and the indoctrination courses in Court customs. He immersed himself, rather, in the rather scant instruction available on the subject of chemistry. Upon his graduation, instead of being commissioned an officer and taking up his career in army social circles, he remained at Russia's West Point as an instructor in chemistry.

Since little attention was paid to chemistry instructors at the Czar's academy, Ipatieff was able to devote a great deal of his time to research—and he was happy at it.

He first gained [*Continued on page* 152]

LONG TOM

"Heavy support" is its listing in the manuals—but our gunners call their 155 mm. rifle "sudden death."

THE story goes that a German field artillery captain, taken prisoner in Sicily, requested an interview with the commanding officer of the American forces. Brought face to face with the officer in question, the German confessed to an intense professional curiosity. Could he, please, take a look at the American automatic artillery?

His request was not granted for a very simple reason—there was no "automatic artillery." In fact, our military experts knew of no such animal. Further questioning revealed that the German had reference to a battery of "Long Toms," American 155 mm. rifles—those sturdy, hard-hitting weapons that bowl the enemy over every time they go into murderous action.

Long Tom's speed and deadly accuracy of fire seem too great to be guided by human controls. To the mechanized German mind there's only one explanation for its performance: automatic controls. The Artillery Officer of the Fifth Army in Italy, after investigating the German reaction to our artillery, reported that "the Germans come and admit freely that they cower with fear when the rifle is finding them." Nothing like Long Tom ever hit them before. They've even made up a special term for the fire of the 155—Zauberfeuer ("magic fire"), an allusion to Richard Wagner's Feuerzauber ("fire magic") in the opera Die Walkuere.

The men who serve Long Tom claim that it's the best gun in the war. As a matter of fact, Long Tom is well on the way to become as famous in this war as did the French 75 in the last, not to mention the German Big Bertha, the 420 mm. siege howitzer, and the German Paris Gun, the 100-foot eight-inch rifle that shelled Paris over a distance of 80 miles. Already Long Tom's fame has overshadowed by far that of the much-touted German 88.

Other American pieces, like the 155 mm. howitzer and especially the 105 mounted on a half-track, have made their mark too, but artillery officers yell loud and long for Long Tom at every opportunity. The landing on

With a ground-shaking blast, a battery of Long Toms hurls 95-pound projectiles at targets that are over 17 miles away. Gunners seldom miss!

Italy was made without Long Toms at first, 105's being brought ashore to knock out German tanks in a hurry. But on the fifth day of the fighting Long Tom joined in the shattering chorus, because the experts found they needed this piece with its heavy shell, long range, and simply incredible accuracy.

On one occasion "A" Battery of the First Battalion fired two trial rounds at an enemy battery during the North African campaign. After that the battery fired a mere three volleys for effect. And after that the gunners could sit down and grab a smoke—that particular mission was accomplished. In another situation some Long Toms took on an enemy battery at 21,000 yards and wiped it out with such dispatch that a British brigadier called on the American gunners in person to express his pleasure.

Long Tom's full range hasn't been published yet, but reports indicate that it does well anywhere between 9,000 and 21,000 yards. Its shell weighs about 95 pounds, a load which can do plenty of damage, especially when it arrives at high velocity. A gun that throws shells of such weight is considered "heavy support," since it is more ponderous than field guns and field howitzers but doesn't have the sledgehammer effect of siege artillery.

During Long Tom's infancy, experts wondered about its usefulness for anti-tank work and proposed AP (armor-piercing) ammuni-

by Willy Ley

With one of these six-inch babies, projectile and propelling charge have to be loaded separately by hard-working gunners.

tion for it. But today the rifle fires ordinary HE (high explosive) shells. The colonel of an American Tank Destroyer Force explains that "When a tank gets hit by HE, it blows the side of the thing right in. If the tank gets hit with AP and the hit isn't in a vital spot, the shell is just as liable as not to make a nice round hole in one side, pass through the tank, and make a nice round hole going out on the other side."

It's amusing to recall that for awhile the Long Tom was scorned by some as being too heavy and too unwieldy for field work. There was actually an investigation going on to determine the rifle's value—but before it could get anywhere Long Tom began slugging in Africa and the criticism changed overnight to the most exuberant praise. Today everybody recognizes that although it is almost a heavy piece the Long Tom has great versatility and high mobility, being capable of rushing around at 35 m.p.h. on ordinary roads.

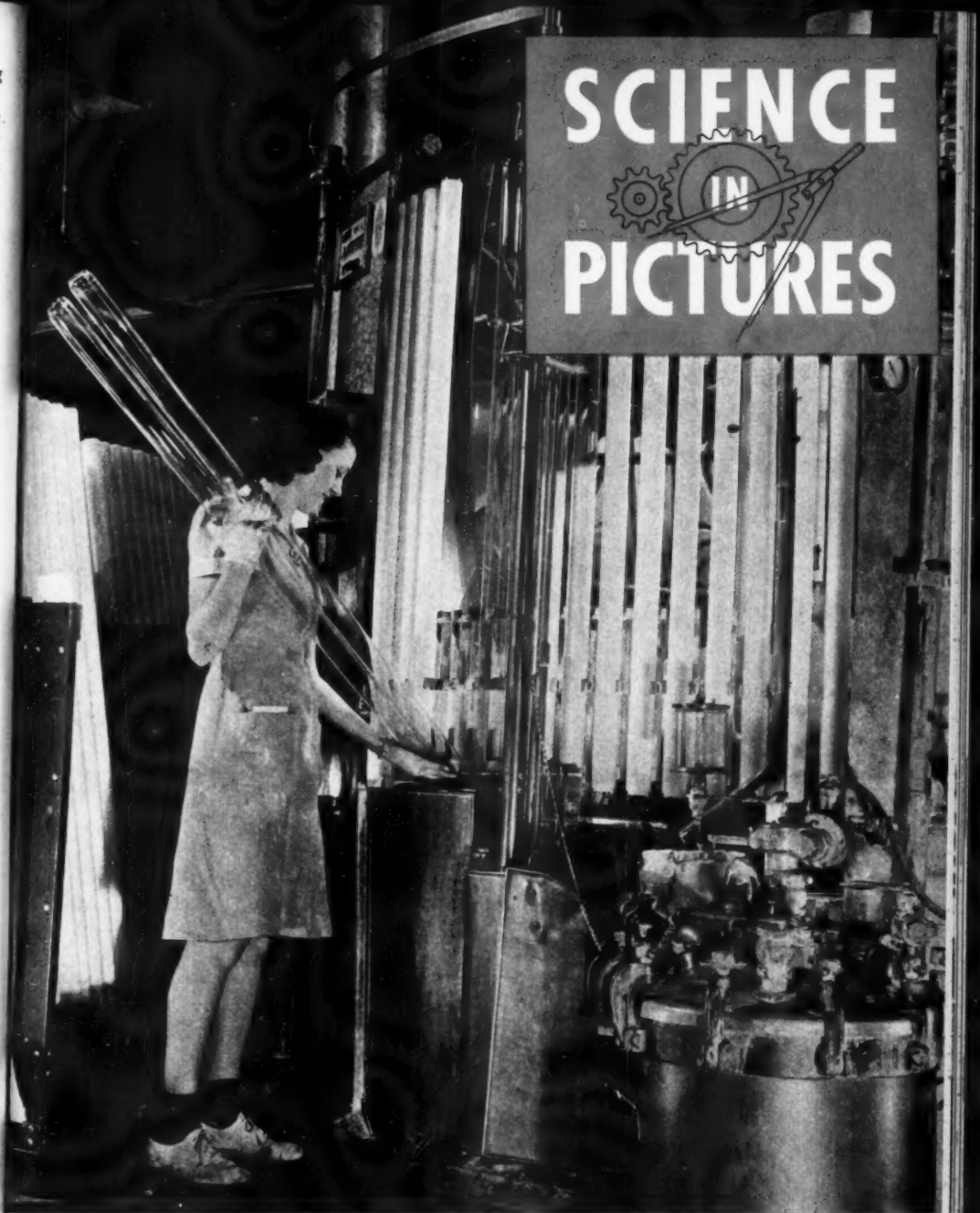
During the first World War such mobility was unheard of and not even attempted for ordinary field guns and field howitzers that fired 13-pound shells at anything within range—enemy trenches, encampments, observation posts and batteries of about the same size. If the enemy dugouts were substantial the 105 mm. howitzers with their 33-pound shells were called in, but good solid fortifications would withstand their fire. Near the end of the last war ordnance men began to wonder about pieces of about six inches, firing 100-pound projectiles.

Very rapid fire could not be expected of these pieces, because their ammunition had to be of the separate loading type. The shells for the three-inch (75 mm.) and four-inch (105 mm.) pieces could still be attached to the cartridge case with the propelling charge without getting too heavy for a man to handle. Professionally this is called fixed ammunition and it makes for fast fire since both projectile and propelling charge are loaded in one piece. But that doesn't work with a six-inch piece, whose shell alone weighs close to a hundred pounds. In such a case projectile and propelling charge have to be loaded separately, a process which, naturally, takes more time. It has the one advantage that unnecessary strain on the gun barrel can be avoided if the range is comparatively short. Since the propelling charge comes separately not all of it has to be loaded if it is not required.

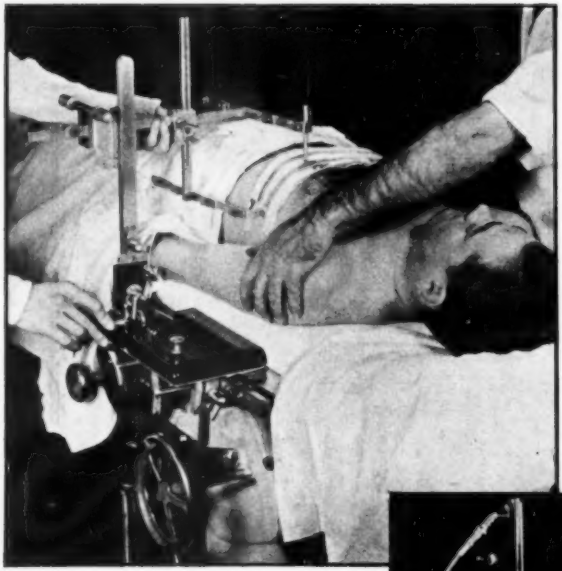
Long Tom is big, but it's plenty light on its feet. This piece travels along roads at a 35-mile clip, can be set up in seconds.

The two pieces that finally emerged near the end of the last war were the German Langrohrgeschuetz (160 mm.) and the French Grande Puissance Filloux (155 mm.) with an extreme range of 17,700 yards. The former has given rise to the present German 150 mm. and 170 mm. while the latter may be regarded as the prototype of Long Tom. Long Tom still has to use separate loading ammunition, but otherwise it shares nothing with the Grande Puissance Filloux but the caliber. The original was used mostly for counterbattery (the shelling of enemy artillery) and against distant troop concentrations.

Long Tom also serves for counter-battery. But it does almost everything [*Continued on page* 157]



THERE are eight different colors of fluorescent lighting, ranging from daylight to pastel red, at the Westinghouse Lamp Division. These five-foot-long 100-watt lamps are having "liquid" light applied by an automatic machine that coats, drains and heat-dries in one operation. The liquid is made up of phosphors, a mixture of metallic salts that gives off visible light when jostled by invisible ultraviolet rays in the tube.

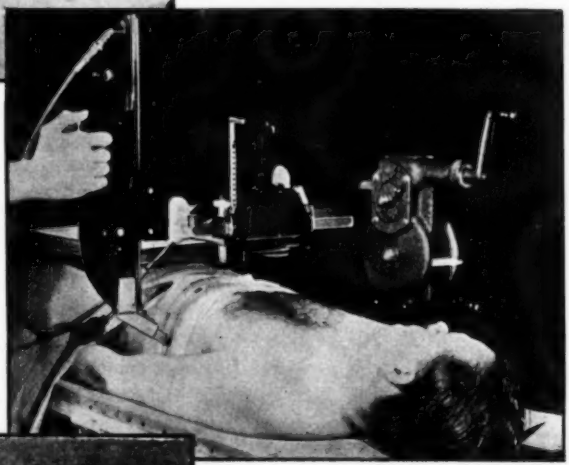


X-Ray Super-Sleuth For Wounded

COL. A. A. DE LORIMIER, commandant—Army School of Roentgenology—Memphis, Tenn., recently demonstrated Westinghouse's new field hospital X-ray unit. This marvelous device (called a Bi-plane Marker and Re-orientating machine) enables surgeons to locate bullets or fragments in wounded men. At left, the re-orientating device assures same position of patient on operating table as he assumed when he was X-rayed. The Bi-plane Marker is in operation. (Below.)

Bi-Plane Marker

THE bi-plane marker marks the patient with iodine at a point directly above the fragment and at another point horizontal to it. Thus is swift surgery materially aided. Localizing a foreign body in two planes, vertically and horizontally, gives the surgeon at least two accurate points of entry, saves time, eliminates hit or miss tactics.



Back, Leg, Clothes Saver For Gardeners

LONG boards cut to the length of your rows, a couple of planks, nails, half-heads of old croquet mallets for wheels and you can knock together this efficient mobile garden bench. Lower models should be made for sowing or setting out seedlings, higher ones are indicated for use in orchards, etc. This invention is just what the tired gardener needs for spraying, dusting, pruning, thinning and harvesting.

LIGHTER MOMENTS with fresh Eveready Batteries

"Say, Red, do you suppose this is what the Military authorities mean by 'mopping-up' operations?"

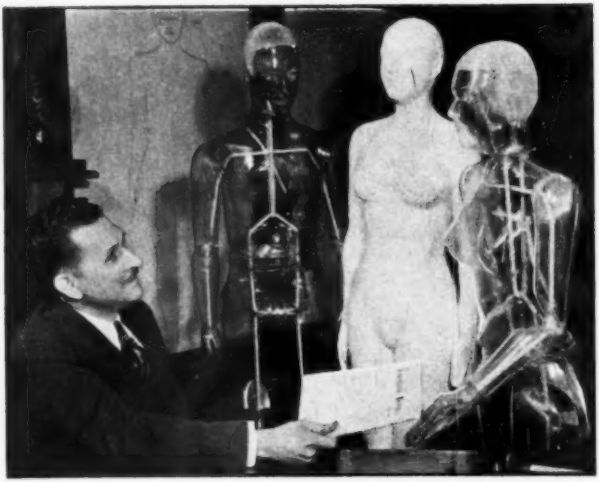
Your dealer is very likely to be out of "Eveready" flashlight batteries right now. There are two reasons for not blaming him. One is that nearly all we can make are going to the armed forces. The other is that war industries are making good use of most of the rest.

FRESH BATTERIES LAST LONGER... Look for the date line →

That pint of blood that will save a soldier's life can't be bought—it must be given. Will you give yours? There are 35 Red Cross Blood Donor Center Cities throughout the country. Call for an appointment!

EVEREADY
TRADE-MARK

The word "Eveready" is a registered trade-mark of National Carbon Company, Inc.



Average Aerial Aphrodite

WHAT G. W. Borkland calls ladykins are plastic shapes made as models for the three average girls who are members of our WAAFS. One is tall, one medium, one petite. When the uniforms are draped and fitted over these figures, with some exceptions, usual gal has an outfit suitable to that critical feminine viewpoint. Left figure is older mannekin—plaster model is large ladykin, right figure is average. She's 64.9 inches in height.

Rockets That Rocked The Axis

WHEN the Luftwaffe, in its Hitler hyperbole, thought that a blitz of England would be the end of their war, these rockets were in production and, in 1941, proved themselves a secret weapon. They were developed for anti-aircraft use, have accounted for many a German plane. It was the Nazis who were supposed to have developed the rocket to its most efficient form.

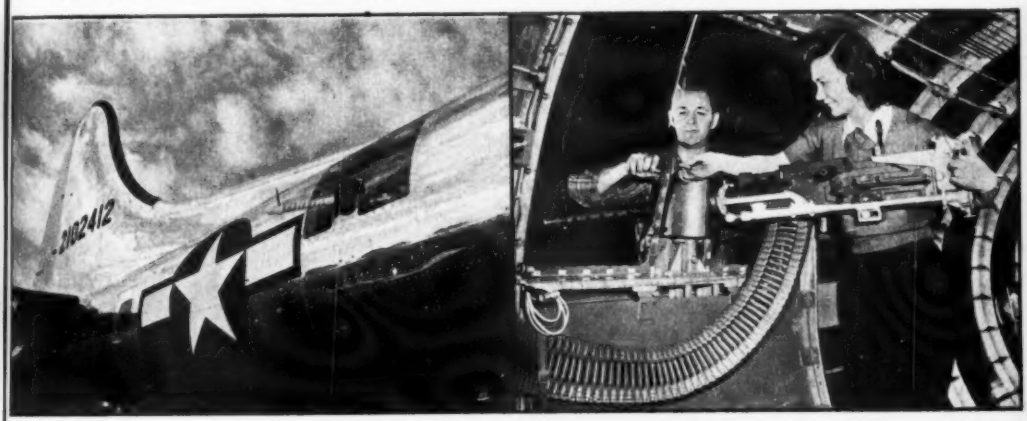
Fast Maneuverable Armored Firepower

AS IF your car were jacked up to meet war needs, its ability to take corners and climb hills and roll along, this new armored vehicle has moved to the fighting fronts. It's called the M-8, weighs 8 tons, can carry a crew of four that handles a .30-cal. machine gun and a 37 mm. cannon. Purpose: Terrain doesn't matter.

Mechanix Illustrated

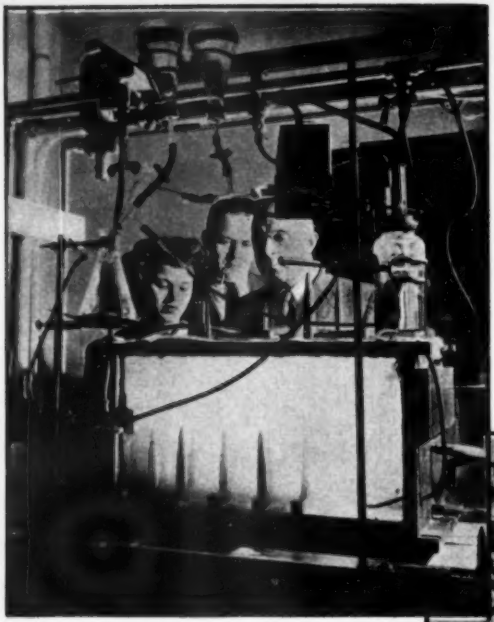
Ordinary Negatives Projected In Full Color

A NEW four-lens projector that will throw a color image on a screen with nothing but plain black and white film in the holder is the latest development in color photography. The unit, invented by Richard Thomas of Los Angeles, takes pictures through filters which separate the color values in pancromatic film into primary elements. then changes them back into their natural hues by light projection.



Warm Hands—Warm Heart—Warm Aim

THOSE brave lads with the frozen hands and faces and guns are going to get a break when the brand new B-17-G fortress takes off with the waist gunner installed in his plastic spot. Nose and tail and belly gunners have long been protected, but now that very valuable marksman, the middle crack shot, gets the same covering. There are two of these fellows and the starboard window has been moved forward to give a staggard arrangement to the two vital guns. There's a wider range of vision for the guy behind the gun, a plexiglass blanket against enemy cold and wind. Such a modification has been dictated by battle and high flight conditions.



Fog Testing Finish Of Shells

FOR awhile certain protective finishes on small arms ammunition turned out to be inadequate in such hard climates as are found in the Aleutians, Greenland, etc. At the Shell-Fisheries Laboratory in Milford, Conn., gun shells are subjected to a cold fog test that proves unmistakably how tough a finish is. The lab is a part of the Fish and Wildlife Service, Dr. V. L. Loosanoff (wearing glasses) is the aquatic biologist in charge.

Heaviest Howitzer In Italy

HERE'S the first photo of the U. S. Army's most tremendous piece of artillery on the Italian front. It's the new 240 mm. howitzer under a camouflage net. Nazi airmen would sacrifice, if they could, a bomber or two to put this terrific long-barreled weapon and its gun crew out of action. The crew, 19 men and an officer.

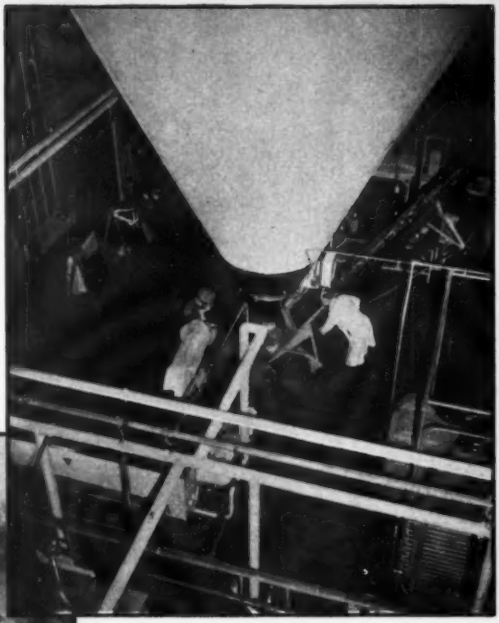
This One Gets Launched Gently

USUALLY great and little ships slip down the ways and make a big baptismal splash. Some ships are even launched sideways. But this 27,000-ton aircraft carrier, Bennington, simply rests on her keel blocks until enough water is admitted to the building dock to float her. At Brooklyn Navy Yard the different method was put into effect—an open end swimming pool system lacking the usual fanfare.

Mechanix Illustrated

Making Breakfast Powder In A Big Way

TONS of powdered eggs for the boys will come out of this huge dryer. In Toronto more than 100,000 Canadian farmers are raising 20,000,000 eggs a month for an egg pool. The "fruit" from these government inspected, pedigreed hens is shipped to immaculate dehydrating plants, is broken, agitated in univats, blown into powder under 6,000-lbs. pressure, packed and shipped overseas. A new process saves all vitamins.



Hot Houseboat Headquarters

ON CERTAIN Burmese rivers the Nips hid their H.Q.'s on old paddle steamers that they camouflaged with cut vegetation in hope of fooling R.A.F. Beaufighter patrols. But the lads in those airplanes know real jungle from Jap-made jungle. This H.Q. houseboat got it straight amidships from aerial cannon, burns like tinder.

England Is Getting Filled Up

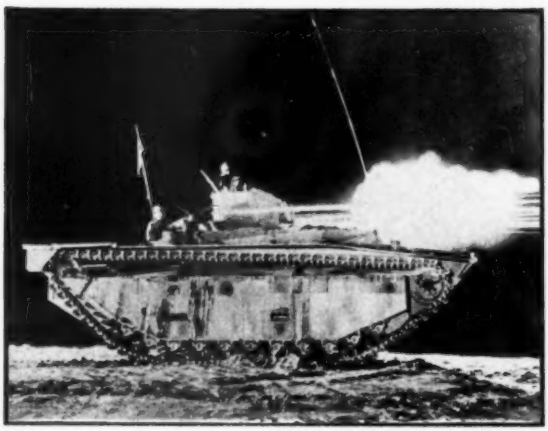
EVEN a rural English lane has become an arsenal for the invasion of Nazi Europe. In this deceptively peaceful scene tons of artillery shells are stored in lane-side bays. Many adjacent fields are open air storage spaces for tanks, guns, trucks, etc. Lend-Lease and British production have seen to it that no lack of materiel will hinder Allied forces when the blows begin.

Make One For Your Office

THAT'S a "letter automat" at left, a home-built device that greatly increases the flow and length of letters from members of the Owens-Corning Fiberglas Corp. to former workers now with the armed forces. A roll of teletype paper feeds the opening in the desk. Each writer cranks his message out of sight. One service man a day is picked to receive the group letter

Ol' Rocking Chair (Electric)

MUCH delicate electrical apparatus is mounted on the super-structure of our warships. Away up there the roll from heavy seas is greatly exaggerated. Westinghouse engineers have developed this 50-ft. "rocking chair" that swings back and forth to test controls for such sensitive apparatus. A steel mast, it duplicates ocean effects.

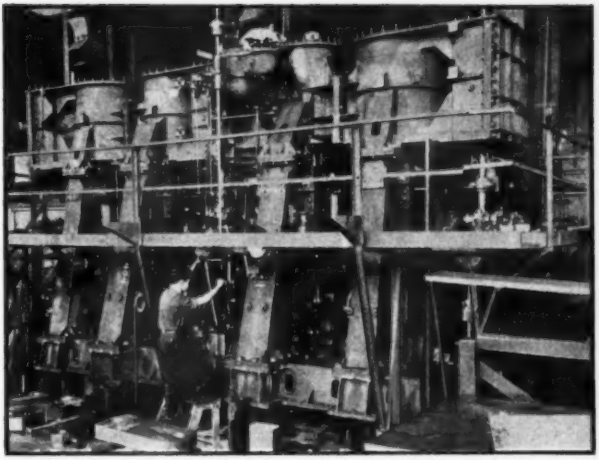


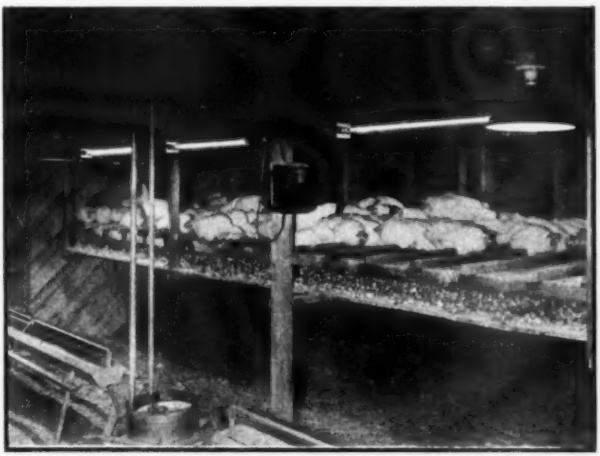
New Amphibious Stream Of Death

A NEW water buffalo with a terrific kick has joined our fleet. This amphibious tank, LVT (A)-I, has a turret superstructure (lacking in earlier models), does its killing now with a 37 mm. cannon and two 50 cal. machine guns. A fast, maneuverable tank on land, the buffalo sinks low in water when loaded and makes a tough target for the enemy. Coral reefs can't stop its tracks.

Powering The D-E Fleet

THOSE destroyer-escort vessels, nemesis of Axis U-boats, have two of these 50-ton steam engines driving them along the convoy lanes. They are specifically designed to provide the remarkable maneuverability and toughness demanded in Atlantic warfare, are particularly valuable because of simplicity of operation and maintenance, and speed at which they can be produced by York Corp.





New Chicken Health

STERILAMPS protect hens from air-borne bacteria in the well-tended farm of today. In brooder rooms birds grow to range size in five weeks instead of eight, mortality is about 68 per cent lower, feathering is more rapid, plumage and pigmentation are superior. At left, in laying house, use of the lamps has reduced incidence of disease to a minimum in 400 similar hatcheries surveyed by Westinghouse.

How Billy Mitchell's Baby Has Grown

TAKING on the savage aspect of Chennault's P-40 Flying Tigers, the twin engined medium bomber that gave it to Tokyo (the B-25) roars around with its new armament backing up its beast of prey appearance. A 75 mm. cannon juts from the lip-hole of the nose, twin "fifties" stick out above. The Mitchell has become a realization of a dream—flying artillery.

For The Commuter Not The Dentist

THE Boston and Maine Railroad does not plan to lug a dentist and his equipment along. On the contrary—this seat, grim as it looks, is being used to obtain the ideal measurements for the train seat of tomorrow. Dr. Ernest A. Hooton of Harvard University will use it in tests on 3,000 potential passengers. The young lady checks the back and seat for angles and height of comfort for an average. No more tired travelers' backs.

Front Line Arboreal Switchboard

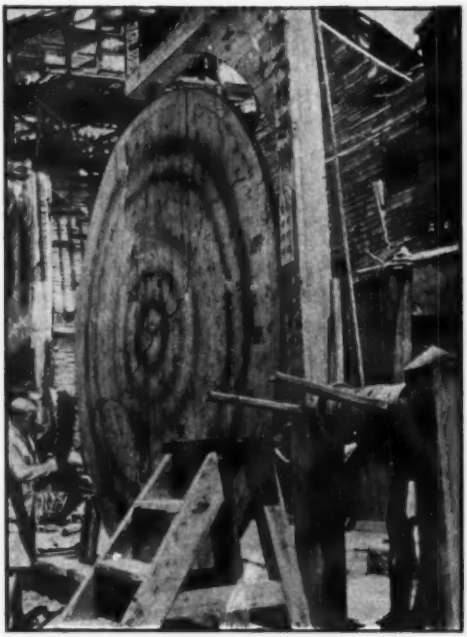
"SOMEWHERE in the Southwest Pacific" can certainly get its wires crossed now—even as you and I. A Marine corporal has rigged up as sweet a switchboard as you'll find in any hotel. It doesn't seem to bother him that his lobby is a jungle within bombing range of the Japs, but that's the Marine of it anyway.

"Matilda"—The Guinea Pig Cylinder

LAB tests of the new internal combustion engine fuels are managed with the help of "Matilda," a full-scale airplane engine cylinder. Also she tests lubricating oils. She's behind that window, the oscillograph that records tests is in foreground. She developed a 50-miles-to-a-gal. fuel.

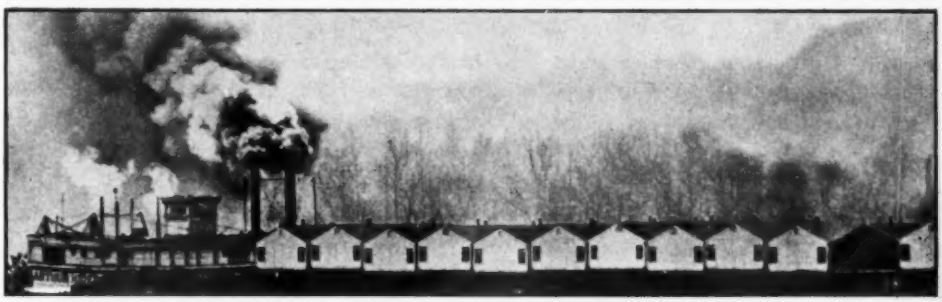
Artillery Newspaper Aimed At Nazis

LEAFLETS are packed into cardboard shell containers, shot over German lines by Allied artillery or dropped by plane. A copy of "Frontpost" (right center) shows one method of keeping Krauts posted on the truth in world news. When fired, the shells explode about 300 ft. up, shower the enemy.



Enemy Airplane Wheel Of Fortune

THE bomb-bedeviled people of Chungking, China, have set up a weird wheel of fate. It's a circular street corner map of wood to which small colored planes are pinned, telling the folks just how many enemy planes are approaching and how far away they are. Man at left is about to pin up the latest raid news.



A Village On Barges Changes Location

MANY people along the Ohio River in and near Cincinnati stopped to gawk recently at this novel method of inland transportation of a village. The steamer Arthur Hider pushes 15 barges that are loaded with 30 four-room houses from Point Pleasant, West Va., to Camp Breckinridge, Ky. Old stern-wheeler solved a housing problem.

America's War Made Industry—

ELECTRICAL APPLIANCE REPAIRING

OFFERS BIG MONEY—INDEPENDENCE

The restrictions on the manufacture of electrical home appliances has greatly increased the need for and earnings of skilled home appliance repairmen. Always a good business, today ELECTRICAL APPLIANCE REPAIRING is one of the most profitable occupations that the average mechanically inclined man can turn to. On many types of repairs it is usual for a repairman to charge on the basis of $5.00 to $6.00 an hour! Work as many hours as you wish—a home appliance repairman is his own boss. Operate from your garage, basement, vacant store, etc.

NEW COURSE TELLS ALL

If you are mechanically inclined—can hold and use tools—you too can be a big money-earning home appliance repairman. Age is no barrier—nor are minor physical handicaps. Learn how to repair refrigerators, vacuum cleaners, washing machines, motors, ranges, etc., etc. Our course is written in simple, easy to understand language, profusely illustrated with drawings and photography showing you step by step what troubles to look for and how to repair them. Explains and gives you a working knowledge of electricity, welding, nickel plating, etc. Shows you how to build power tools you may need and how to solicit and keep business coming to you. Not a complicated "theory course" but an honest to goodness course written and used by repairmen the country over. Price of course is so low that the savings on your own household appliance repairs will quickly pay for it. Prepare NOW for a real future.

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Kwajalein Pay-off

[*Continued from page 37*]

before dawn. We moved in close and began a preliminary bombardment, sending shells into the cement wall in a softening-up process.

As the sun rose higher, we began pouring it in with everything we had. The roar and blast of guns grew louder. Other battlewagons and cruisers on both sides of us were joining in.

So far the Japs had held fire. But now we saw splashes in the water, all around us.

It was near the zero hour. Through our glasses we could see that the wall had been knocked flat and could no longer stand as an obstacle to our tanks.

Above us we saw a flight of B-24 Liberators, coming in in two waves, gleaming in the morning sunlight. They flew over the island once and circled back. From somewhere on the island came a few puffs of black anti-aircraft fire. One of our guns fired a few minutes later and the anti-aircraft gun stayed silent.

The B-24's started in on their run. As they came over the target, they unloaded their basket of blockbuster eggs. The bombs came down in graceful flight. You could follow them with the glasses.

A great cloud of smoke and debris lifted up at the tip of the island. It was a direct hit on several Jap pillboxes.

For ten minutes the high level bombers kept at their job. Every stick of bombs was on the target except one which landed a few feet in the water. It was one fine example of precision bombing.

Then the next act began—the dive bombers. This was like watching trained acrobats in the circus. The enemy flak had halted. The planes put their hearts into their work.

One by one they peeled off, hovered a moment high above the point—then dove. Many dives were almost perpendicular. At the last moment they let go their bombs and scooted up out of harm as explosions billowed up behind them.

Next came the strafers, diving to tree-top level —only, as an enlisted man mentioned grimly, there were no treetops left.

Zero hour was here. Boats were already on their way to the beach. Sea-going tanks, landing boats carrying infantry with hand-to-hand weapons were going in.

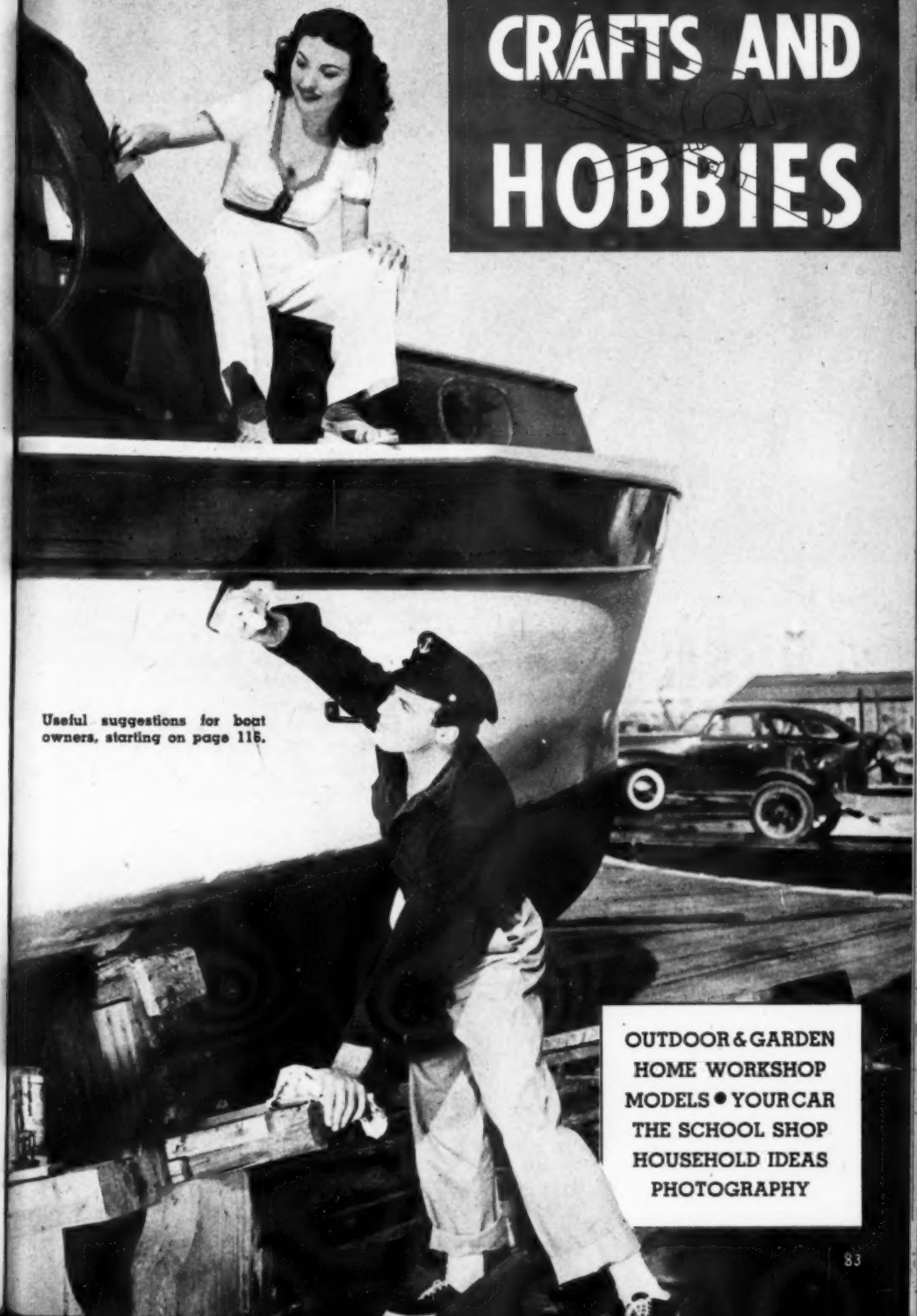
As we finished our climactic bombardment, I looked back to the point we had been pounding. Boats were on the beach and troops were piling out. Tanks were ahead of them, already crawling forward.

Then over the loud speaker came the word. Landing forces had made the beachhead without the loss of a single life.

I glanced to the boat deck and saw the colors—the American flag fluttering in the midst of yellow and white vapours from the guns.

England is turning surplus potatoes into potato flour, alcohol and other needed supplies.

CRAFTS AND HOBBIES



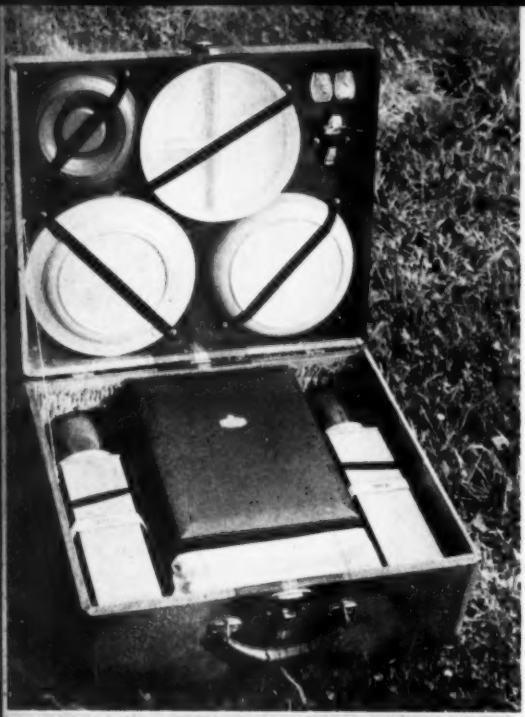
Useful suggestions for boat owners, starting on page 115.

OUTDOOR & GARDEN
HOME WORKSHOP
MODELS • YOUR CAR
THE SCHOOL SHOP
HOUSEHOLD IDEAS
PHOTOGRAPHY

CAMPING AND

This carrying case, made from an overnight bag, will hold all the "works" necessary for that next outdoor snack.

by Walter E. Burton



Here is the completed kit, showing arrangement.

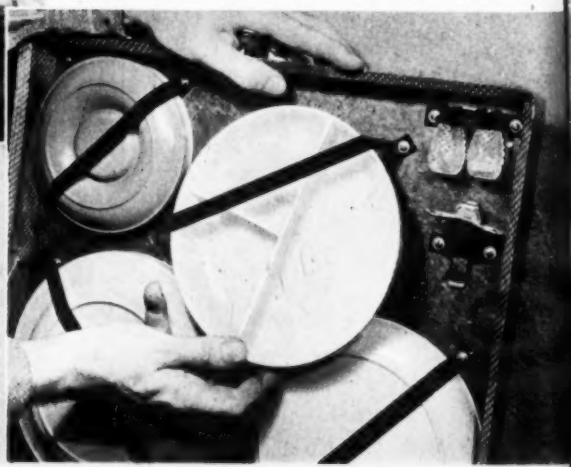
WHETHER it's a week-end camping trip, one-day fishing venture, or just a plain picnic, this handy mealtime kit will increase the fun of outdoor eating. It contains dishes, knives, forks, spoons, vacuum bottles, and whatever else in the line of eating equipment the owner desires to carry. There even is room for a sandwich or two, although usually the food is packed separately.

Most of the stuff you will need to build a kit similar to the one illustrated may be found around the average house. The case is an inexpensive but sturdy overnight bag that may be obtained at most department and luggage stores. In addition, you will need some garter elastic or similar material ½" or so wide, 2' or so of stout cord or tape, several short wood screws and washers to fit, some plywood or similar material about ¼" thick, a few scraps of wood, and some clear lacquer or varnish.

The dishes illustrated are a lightweight plastic type, but chinaware or metal ones can be used just as well.

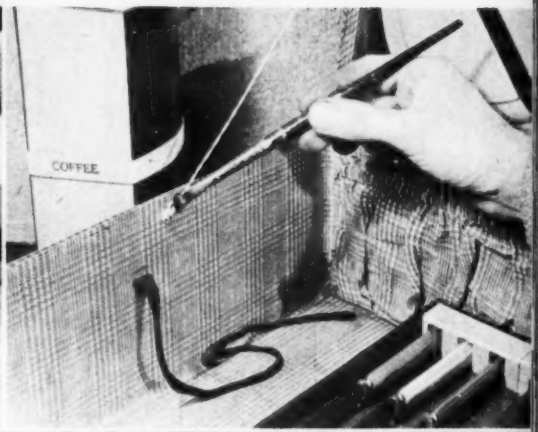
The lid of the case is reinforced with ¼" plywood or composition board. Elastic tape, held with short roundhead screws and washers, holds the plates and dishes. A tray holds forks and spoons between wooden

Plates are held to case lid by elastic tape. Plan layout carefully before fastening strips.



Plates slip easily under tape. Note the salt and pepper shakers and can opener in corner.

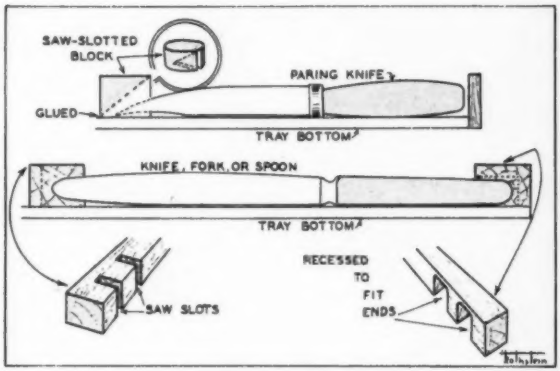
PICNIC KIT



Cutlery is held in separate tray fitting in bottom of kit. Lacquer strengthens knot of cord holding lid.

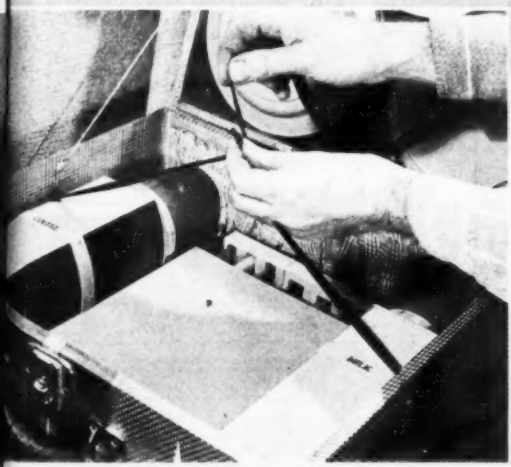
blocks fastened to the bottom, and knives fit in slots in similar blocks as shown. The bottom and sides of the tray are finished in clear lacquer, and the wooden pieces in yellow lacquer.

The tray is placed in the center of the case and a vacuum bottle on each side of it. Two pieces of elastic tape, fastened to the sides, are knotted together over the three and hold them in place; bottles and tray may be removed without untying the tape. On top of the tray is a box with a hinged lid containing cups, sandwiches, etc. Tablecloth and napkins are stowed at one end of the box.



Cutlery fits in wooden blocks as shown above.

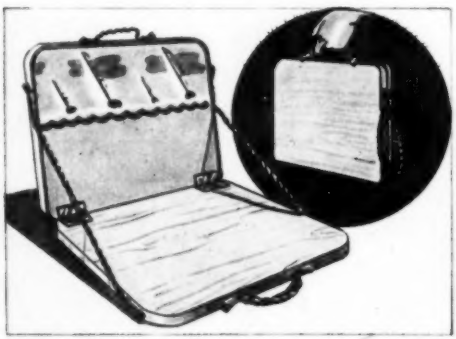
Tape holds thermos bottles and tray and permits easy removal. Case, when closed, resembles ordinary bag.

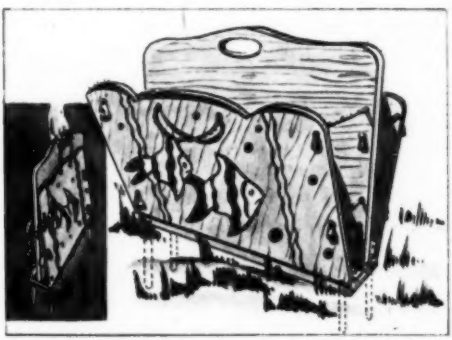


Beach Set for Comfort

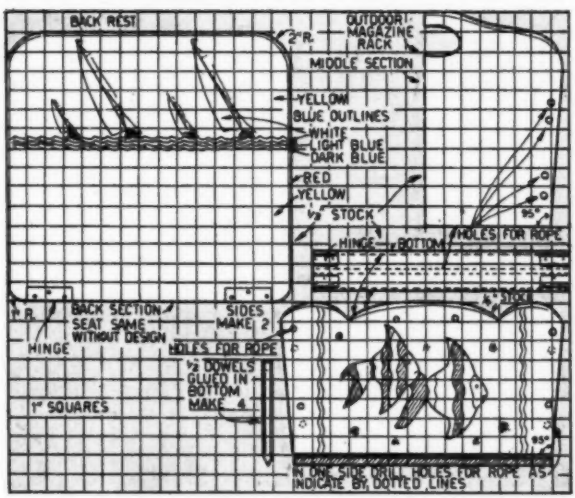
by
R. L. Fairall

Beach seat at center left and magazine rack below are lightweight for easy carrying. Cut out stock as in squared drawing shown at the bottom of the page.





THIS beach set is simple and inexpensive to make, using materials generally available. All wood, with the exception of the outer sides of the magazine rack, is ½" stock. The sides of the rack are ¼" to save weight. Four dowel legs glued in the bottom of the rack prevent it from falling over, as they can be pushed down into the beach sand. The seat is a simple hinged unit as shown, with lengths of rope stapled to the sides to hold it at the proper angle when open. Three staples are used at each fastening point and also on the rope handle fastenings of both rack and seat. Ropes through holes in rack are knotted at correct length.



MOW 'EM DOWN

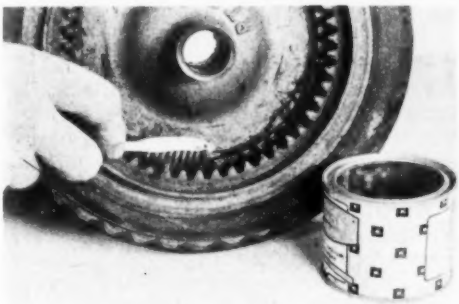
You won't be able to buy a new lawn mower this spring, and so you had better start oiling and sharpening up the old one.

YOU don't have to be a mechanic to fix up your lawn mower, and you don't need special tools, either. You can do a really professional job on 'er if you follow these simple instructions.

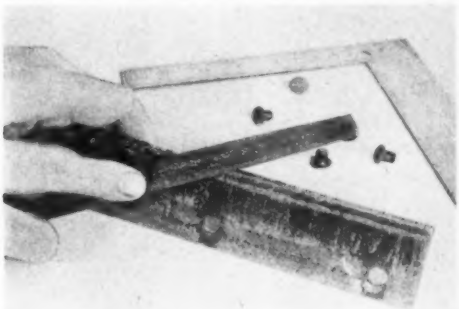
First dissemble the machine and wash the parts in gasoline (if you can spare some of the precious stuff). Remove stubborn grease with a toothbrush. Then, using a flat file, sharpen the stationary cutter blade. Check with a steel square, re-file if necessary, and finish with a medium-grit Carborundum stone. Reverse wheel pinions (right on the left wheel, left on the right wheel) to make the mower blades turn backwards.

Reassemble, adjusting cutter bar so it doesn't bind. Smear a paste of medium-fine Carborundum powder and heavy oil on the cutter bar and push the mower around awhile. The blades will sharpen themselves.

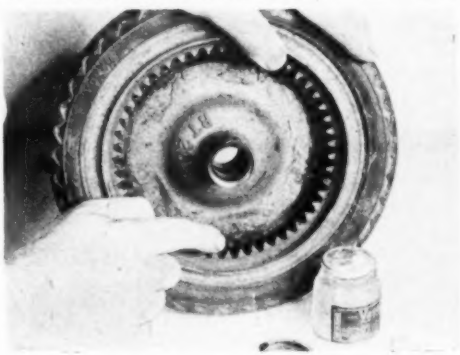
Reverse pinions to make blades turn backwards.



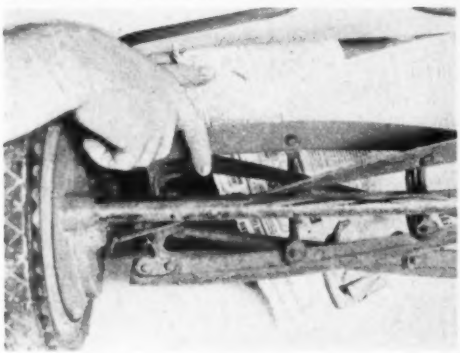
Remove hardened grease from wheel with toothbrush.



Flat mill file will sharpen the stationary bar blade.



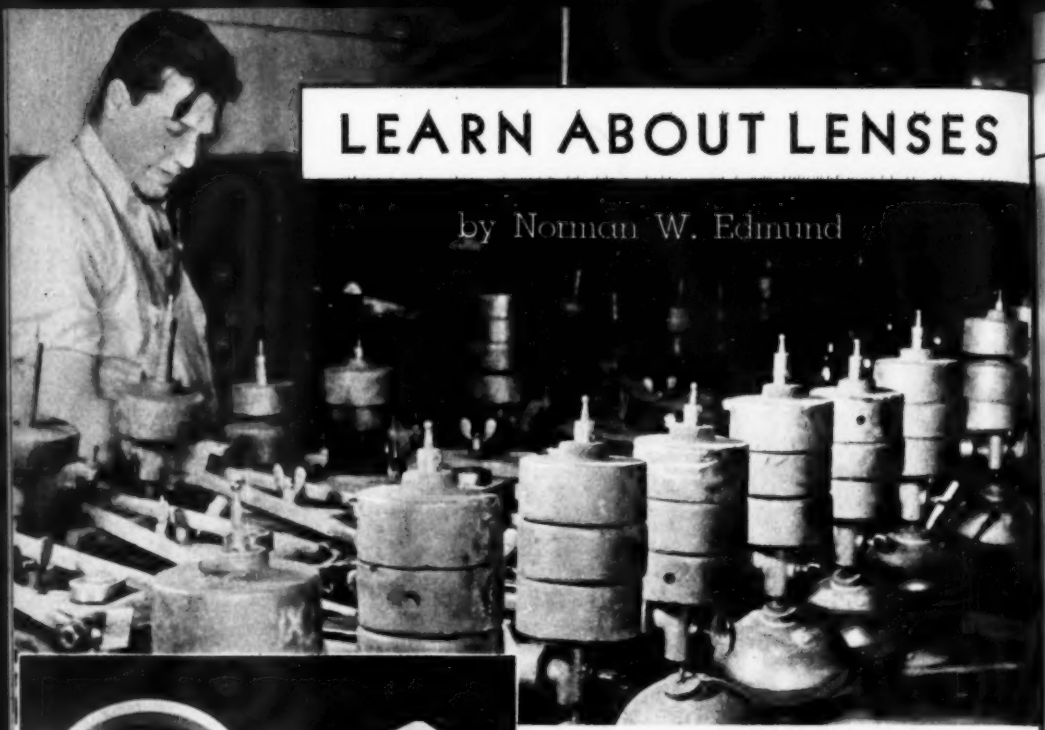
Put vaseline or grease on gear before reassembling.



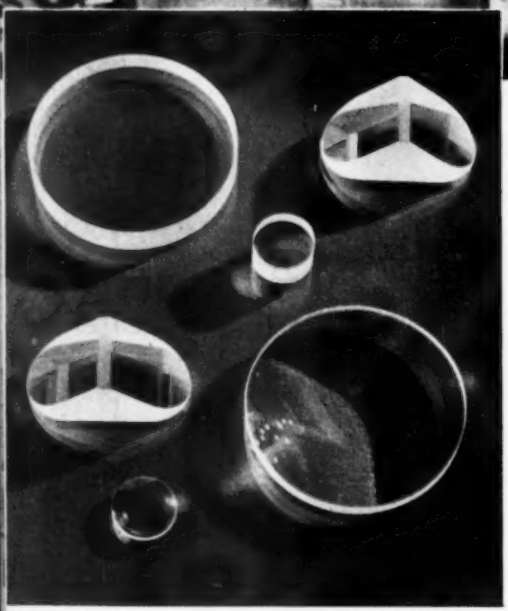
Check for even cutting with a sheet of newspaper.

LEARN ABOUT LENSES

by Norman W. Edmund

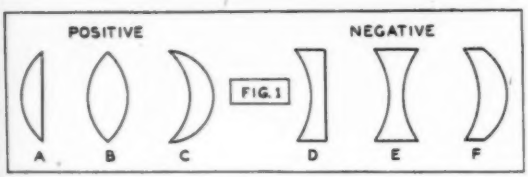


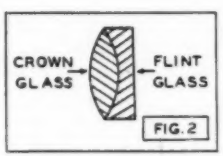
Lens manufacture is a complicated process. Machines like these serve to grind their precision surfaces.



LENSES are playing an important part in our war. To beat the Axis, Uncle Sam is using them effectively in binoculars, range finders, gun sights, fire-control apparatus, aerial cameras, and countless other optical instruments. The theory behind the action of the various types of lenses upon light rays is a simple but fascinating one, and there are many experiments you can perform and many pieces of apparatus you can make in your home workshop to demonstrate the elementary principles of optics. The construction of a simple Galilean telescope (designed by the Italian astronomer, Galileo Galilei, in 1597) is offered as a suggestion.

A lens may be a converging or diverging type. Converging (positive) lenses are thicker in the middle than at the edges and concentrate the light rays to a point, called





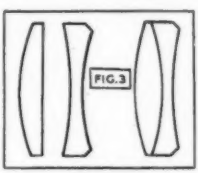


Fig. 1 shows A, plano-convex; B, double-convex; C, positive meniscus; D, plano-concave; E, double-concave; F, negative meniscus. Fig. 2 is achromatic or color-corrected. Anastigmat (Fig. 3) has several elements.

With a working knowledge of them you can make many simple optical gadgets.

the *focal point*. This lens causes a *real* image, one that can be seen on a screen or photographic film. Diverging (negative) lenses are thicker at the edges than in the middle and cause the light rays to spread out in a cone shape. This type causes a *virtual* image, one that can be seen only by looking through the lens itself.

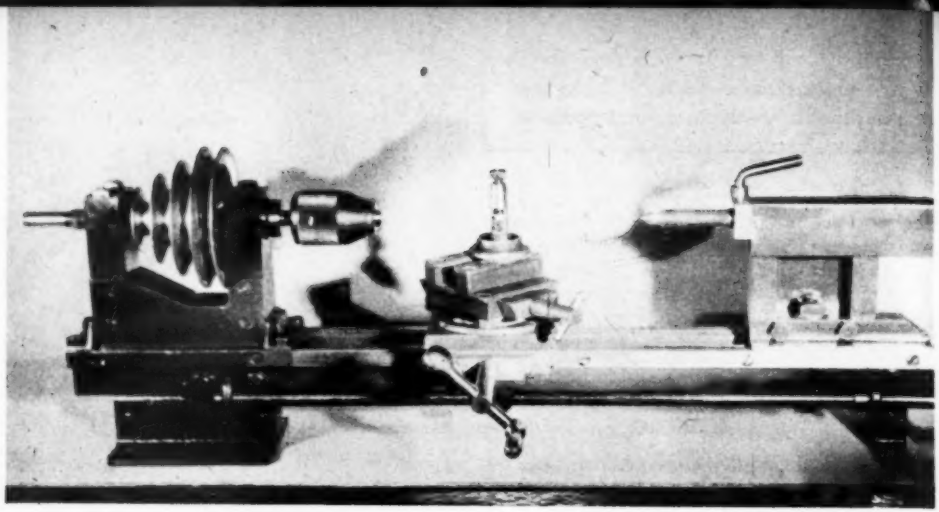
In Fig. I are shown the most commonly used lenses. Each one is a single piece of optical glass. While single element lenses serve excellently for spectacles, magnifiers, etc., there are many purposes for which they are not entirely satisfactory. The reason for this is that imperfections in the lens cause various distortions or aberrations such as curvature of field, chromatic aberration or color distortion, astigmatism, spherical aberration, etc. Through years of experimenting, opticians have learned how to eliminate these aberrations by combining lenses and different types of optical glass. In Fig. II is shown an achromatic or color-corrected lens, formed by combining an element of crown glass with an element of flint glass. This type is corrected for chromatic aberration. Lenses such as these are used in highly efficient binoculars such as those used by the U. S. Armed Forces. In Fig. III is the plan of an anastigmat lens. These are used in photo-enlargers, precision cameras, etc. This type lens may contain from two to ten elements, but four is the usual number.

Single element lenses of the convex type make excellent magnifiers. A double-convex lens is preferable as either side may be used toward the eye. Single plano-convex ones, however, frequently are used and will give good results if it is remembered to turn the curved surface toward the object when holding the lens right up close to

[*Continued on page 132*]

These are optical flats (perfectly flat lenses).

Above: Lens system of a Galilean telescope.
Lens arrangement of the astronomical type.
Terrestrial telescope forms erect image.
In reflector type, eyepiece is at side.
Light through prism separates into colors.
Achromatic lens corrects color dispersion.

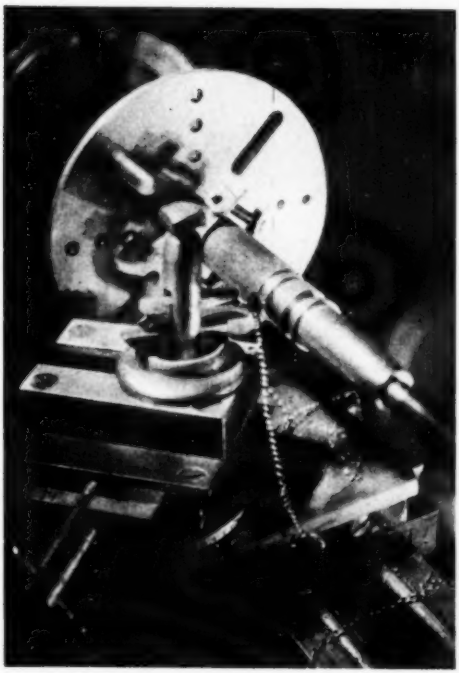


Here the lathe is taking a 3/16" cut in mild steel, and doing it smoothly. It can turn out model engines.

MIDGET METAL LATHE

The present day scarcity of machine tools need not keep you from having a metal lathe; this sturdy little job will work to close tolerances—and it's made from scraps.

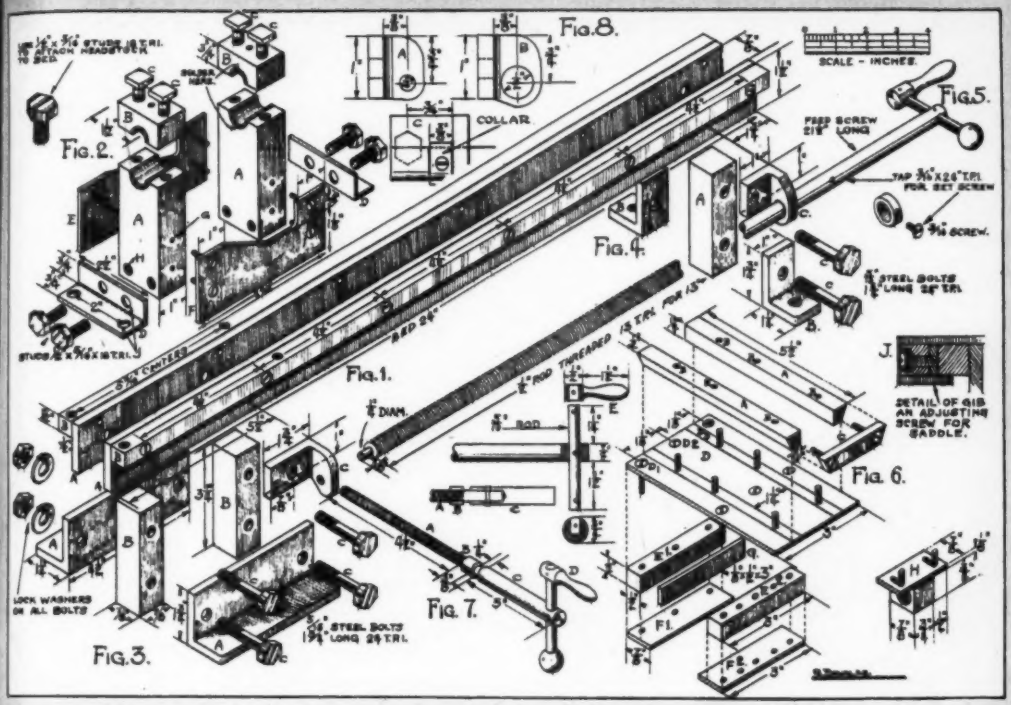
by Gordon Douglas



A GLANCE over the drawings and photos accompanying this article will show what the amateur craftsman and modelmaker can do in the way of constructing a neat looking metal turning lathe for his home workshop. In these days of priorities, such tools are hard to obtain and the average modelmaker at some time or another usually finds the lack of a lathe in his shop a severe handicap to his hobby. However, the construction of the lathe about to be described will prove interesting in itself, and satisfaction in the work that can be turned out on it after its completion will well repay the builder for the time and care spent on it.

This little machine has a capacity between centers of about 8", will handle a 6" diameter nicely over the bed, 4" over the saddle and is husky enough to reduce the diameter of a piece of 1" steel shaft about $\frac{3}{16}$" in one cut without chatter.

The construction calls for no special material beyond what can usually be purchased



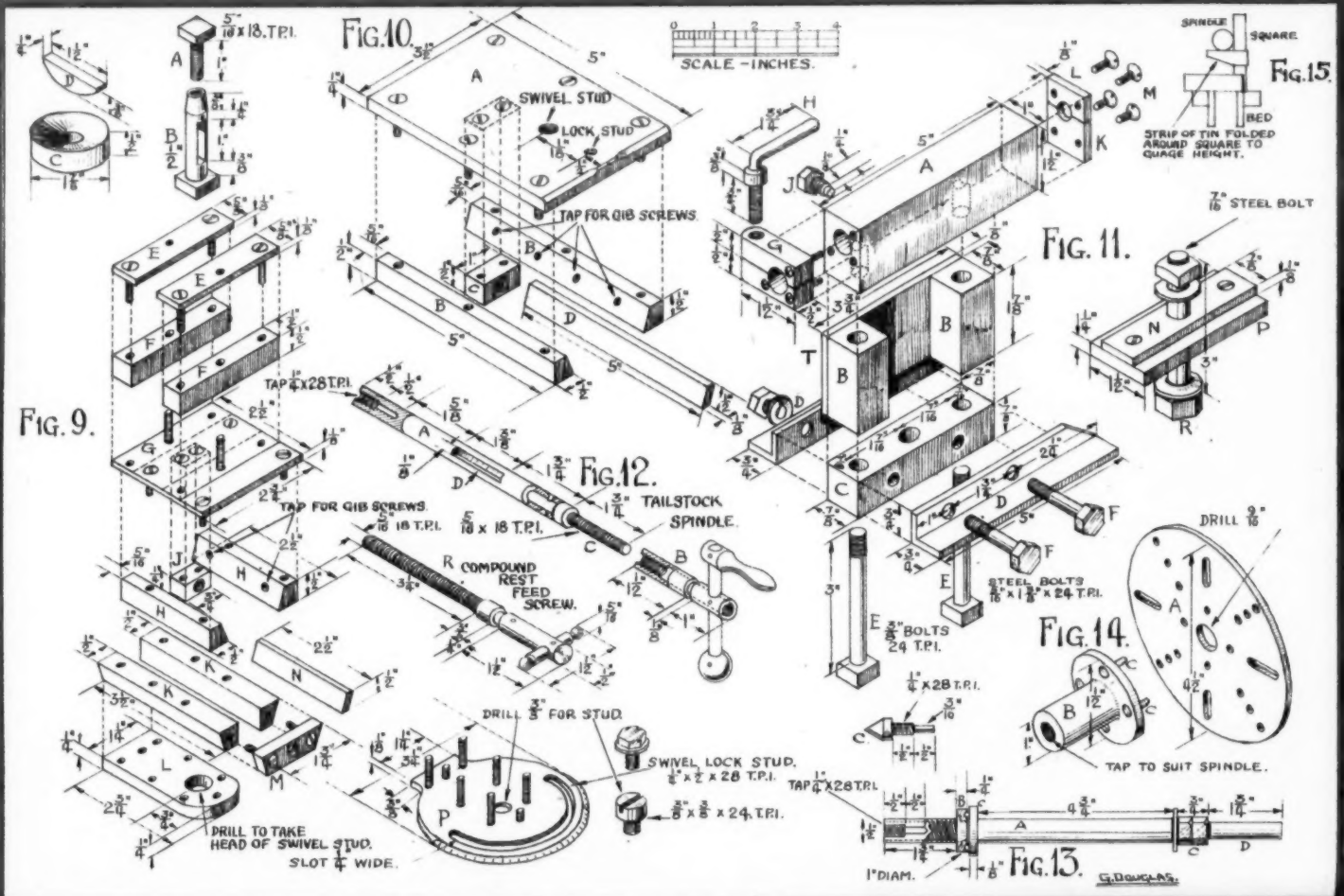
Details of bed, headstock, and feed screw. Screw heads holding square stock on bed must be countersunk.

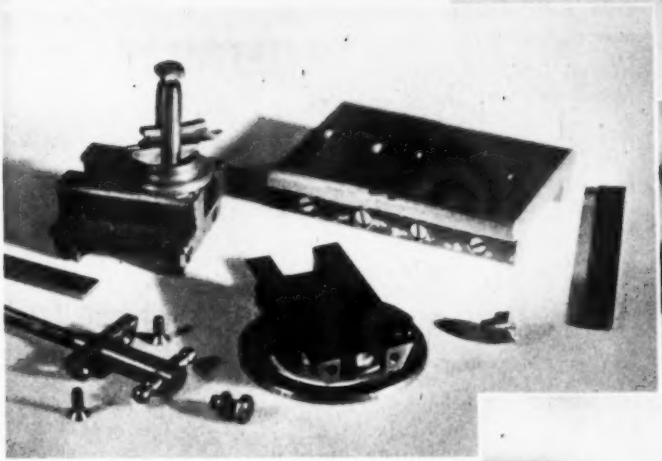
in the local hardware store or blacksmith's shop. In fact the average modelmaker will more than likely find most of the material at hand in his own shop. All of the work in building the lathe was carried out with the use of hand tools, such as hacksaw, round and flat files, and various taps, dies and drills, no machine work being required whatever. All drilling was done on a small blacksmith's post drill turned by hand.

Before commencing the actual construction, study the various drawings and photos carefully, because, although they may look rather complicated at first glance, if you study one part at a time they are in reality fairly simple. Bear in mind also that your measurements must be accurate. This is important, otherwise you will run into trouble before proceeding very far. Use a good steel rule together with a steel square and sharp scriber for marking out the various parts and center-punch all holes carefully before drilling.

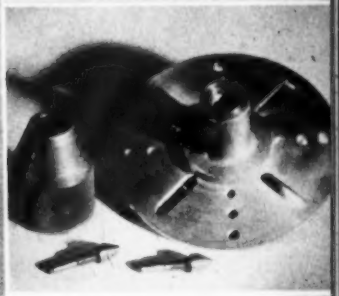
To start the construction of the lathe bed A. and B. FIG. 1, you will require 2 pieces of mild steel ¼"x1½"x24" long and 2 pieces of the same material ½"x½"x24". To make up one side of the bed, scribe a line right along the center of one of the ½" square pieces, then measuring 12" from one end scribe a line across the piece and from this line proceed to lay out the screw holes toward each end on 4½" centers as shown. Center punch these holes and drill $\frac{5}{32}$" countersinking them with the point of a ⅜" drill and making sure the screw heads come well below the surface. Treat the second ½"x½" piece in the same manner. Now lay these two pieces on their sides on some good flat surface, and set the two ¼"x1½" pieces on edge against them and clamp them together, that is, clamp one of the ½" square lengths to one of the 1½" pieces—not all four together. When you are sure you have these parts all square and level, proceed to drill the holes in the 1½" stock, using the previously drilled holes as a guide. When this has been done, remove the clamps and tap these holes $\frac{3}{16}$"x24" threads per inch to suit standard $\frac{3}{16}$" flat headed stove bolts. I might say here that these bolts are used throughout in place of special machine screws and will be found quite satisfactory. Next open out the holes in the ½" square pieces with a $\frac{3}{16}$" drill and screw them in place cutting off any surplus length of screws and filing

Compound rest, tailstock, spindle, and faceplate details. Shape compound rest carefully to avoid chatter.





Left: Compound rest assembly. Below: Chuck (drill type) faceplate, and centers.

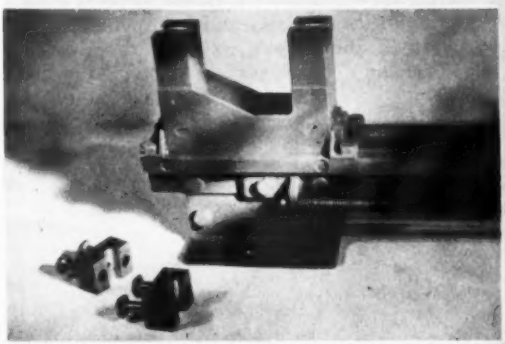


Headstock spindle. Ball thrust bearing is used.

down smooth. This operation completes the two sides of the bed. You can now proceed with the base for the headstock end Fig. 3. This is built up from angle iron and ⅞" square iron as shown in the drawing. Take one piece of the angle iron and mark off the two bolt holes on a center line $\frac{1}{16}$" from each end and drill $\frac{5}{16}$". Next, assemble the two square pieces upright between the angle irons and clamp the whole thing firmly together. Using the first two holes as guides, drill through the uprights and the other angle iron inserting the two $\frac{5}{16}$"x1¾" bolts and tightening up with lock washers under the nuts before removing the clamps. The small base or leg for the tailstock end is built up in a similar manner.

To assemble the bed to the base, lay the two sides upside down on a level surface as before and place the headstock and tailstock bases between them, 1" and ¾" respectively from each end of the sides. Clamp all four parts together and drill three $\frac{5}{16}$" holes to come through the top centers of the three uprights. Insert the bolts and tighten up before removing the clamps as before. This completes the bed assembly and you can now start the construction of the headstock.

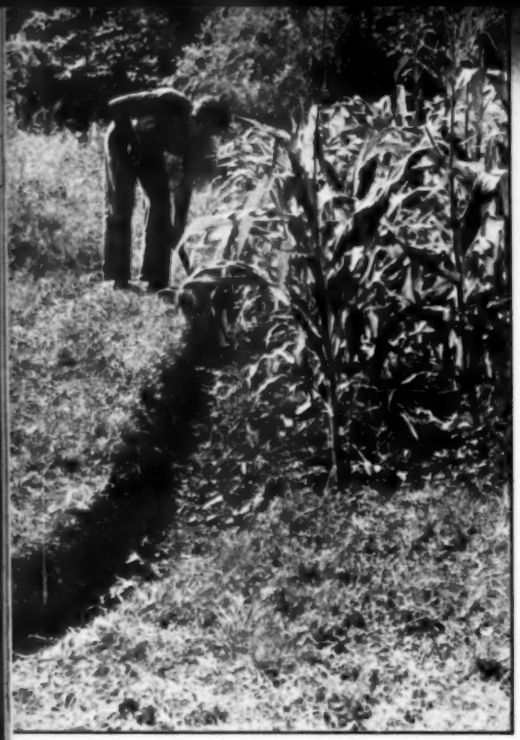
This part is built up from 1"x1½" mild steel, ⅛" steel plate, and ¾" angle iron as shown in FIG. 2. The two spindle bearings A. A. should be made up first. Measuring ¾" from one end of each piece, saw these parts off to form the two caps B. B. After filing up square, mark off and drill the holes for the studs C. to clear $\frac{5}{16}$". Drill ¼" holes in [*Continued on page* 132]



Headstock is shown (above) with top half bearings removed. Note feed screw. Below: Tailstock assembly.

DRAINING WET

If your Victory garden is situated on low, damp ground, follow these simple methods for avoiding excess moisture.



Trench will by-pass surface water on sloping plots.

THE job of draining a low-lying garden, that is subjected to excess water during and after heavy rains, can be simplified if the source of the excess water is determined beforehand. The suggestions contained in the accompanying drawings may give you the clue for determining the source in your particular case by helping you analyze your own garden layout and how it collects moisture.

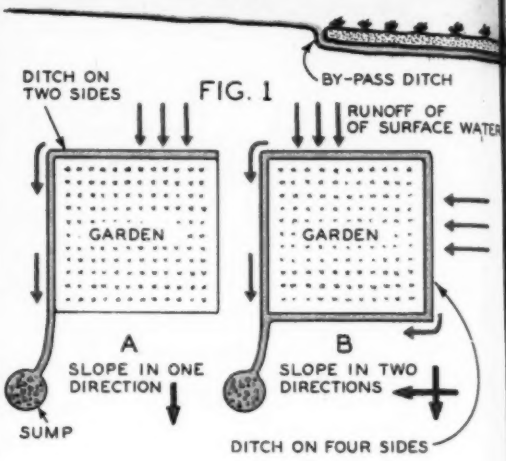
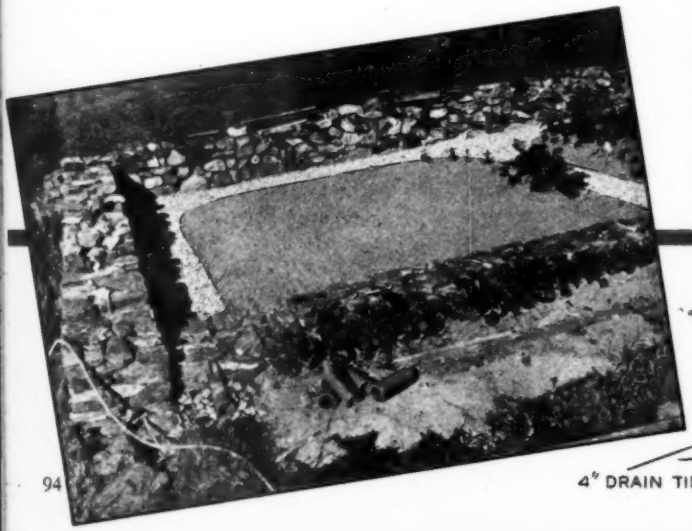
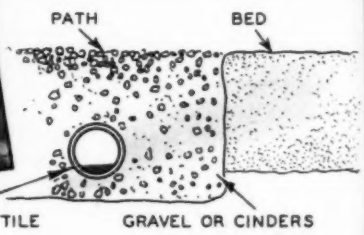


Fig. 1 illustrates a simple remedy for a wet garden located on low-lying sloping land. Gardens so situated are apt to receive entirely too much moisture to insure healthy plant growth unless a means is provided for by-passing rain and other surface water that would otherwise flow into them. If the plot slopes in just one direction, adequate by-passing of the water can be accomplished by means of a ditch that runs along the top and down one side of the garden as shown at A. Where the land slopes in two directions, as at B, run the ditch entirely around the garden, and then continue it down the slope and

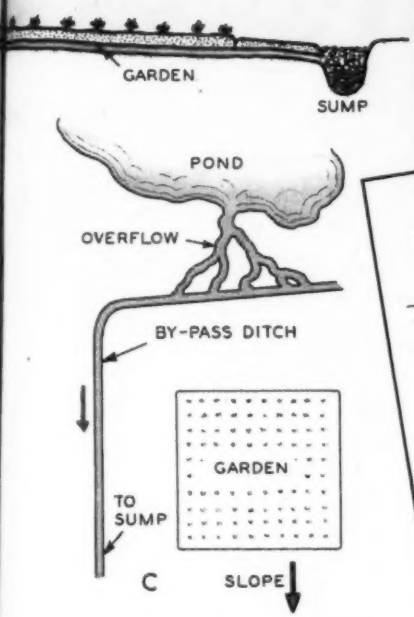


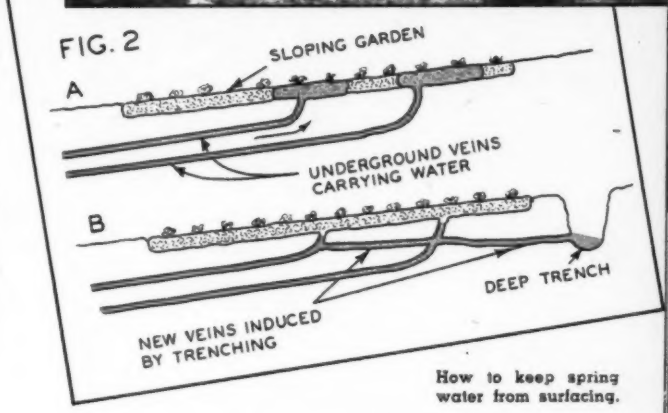
Tile pipe, buried in a gravel path around the garden, drains the beds.



GARDENS

by J. Modroch





How to keep spring water from surfacing.

lead it into a sump as illustrated. A pit or a dry well (pit filled with stones) will serve this purpose. The depth of the ditch and the size of the sump should be determined, of course, by the amount and rate-of-flow of the water to be by-passed. A ditch about 6″ deep will be found adequate for the runoff from average rainfalls.

Where the greater portion of the runoff emanates from the overflow of a pond located above the garden as shown at C, the flow can be expected to continue for some time after a long rainfall, depending on the size of the pond. In this situation, it is advisable to locate the by-pass ditch several yards above and to the side of the garden in order to protect it from prolonged wetness due to seepage from the ditch. This layout permits the soil in the garden to dry out at a normal rate.

Small surface springs that are active only during wet periods are liable to crop up anywhere. Where one surfaces in a garden bed, it usually spreads through the cultivated topsoil, causing a soggy area that rots seeds and retards germination. The remedy for this trouble is to prevent [*Continued on page* 136]

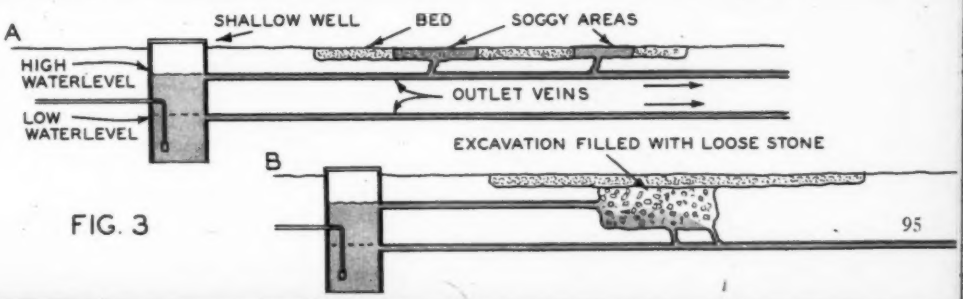
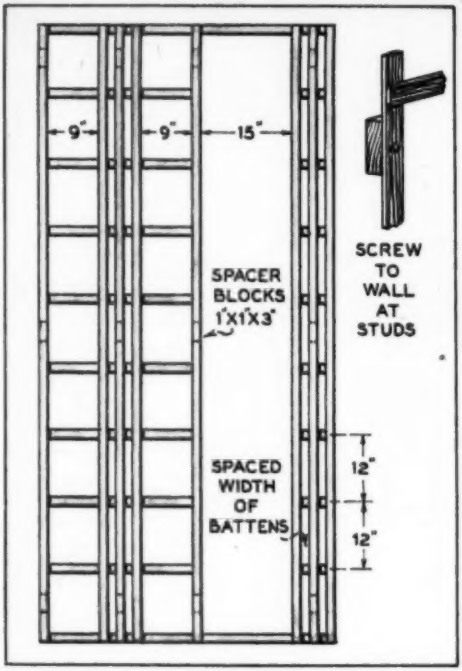
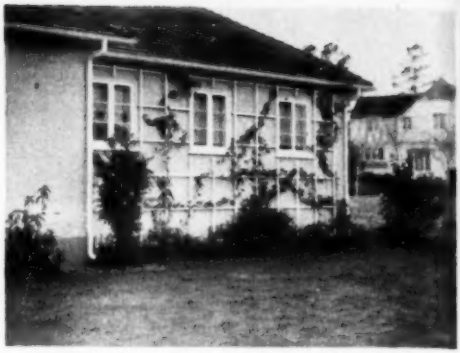


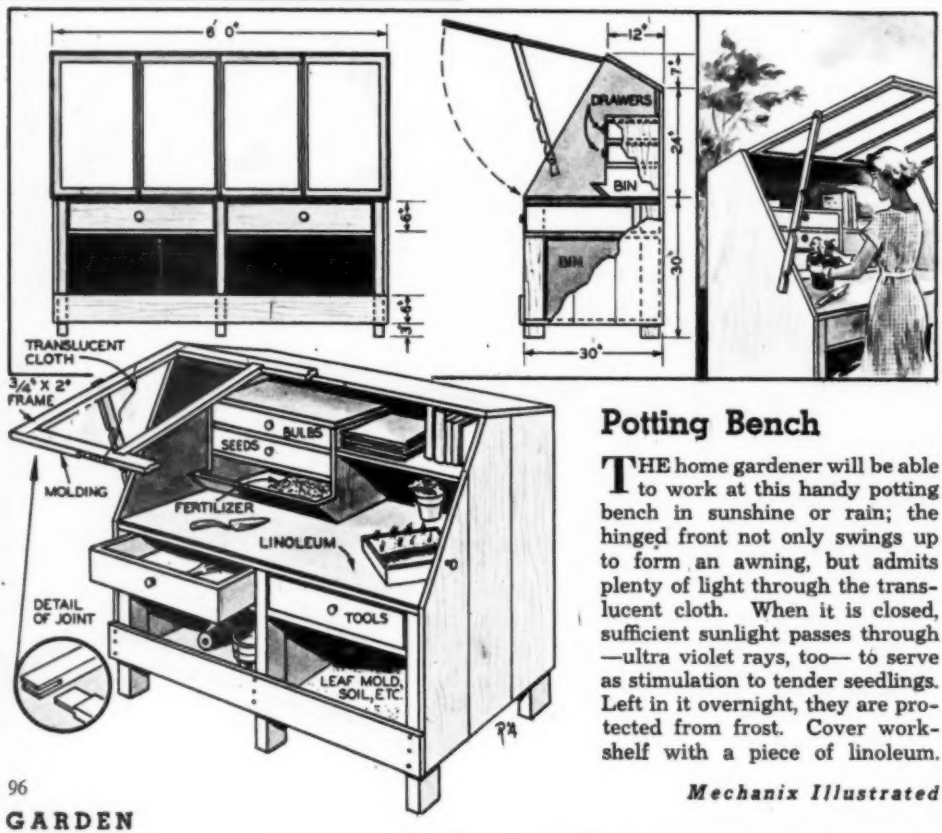
FIG. 3





Wall Trellis

AN ATTRACTIVE wall trellis such as that shown in the top photo can be made of battens, which, incidentally, are on the non-critical list. If your wall is stucco, drill test holes to locate the studs beneath the stucco and fasten the battens to them with spacer blocks as shown. Screws are better than nails for this purpose. Wall studs are placed 16" apart in standard practice.

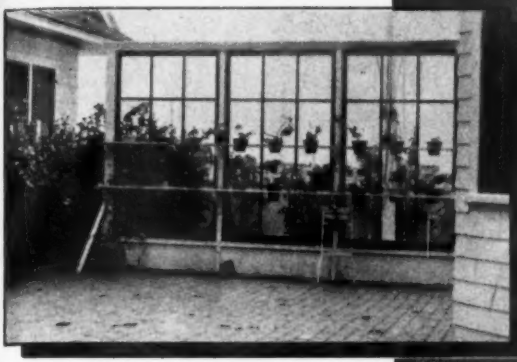


Potting Bench

THE home gardener will be able to work at this handy potting bench in sunshine or rain; the hinged front not only swings up to form an awning, but admits plenty of light through the translucent cloth. When it is closed, sufficient sunlight passes through —ultra violet rays, too— to serve as stimulation to tender seedlings. Left in it overnight, they are protected from frost. Cover workshelf with a piece of linoleum.

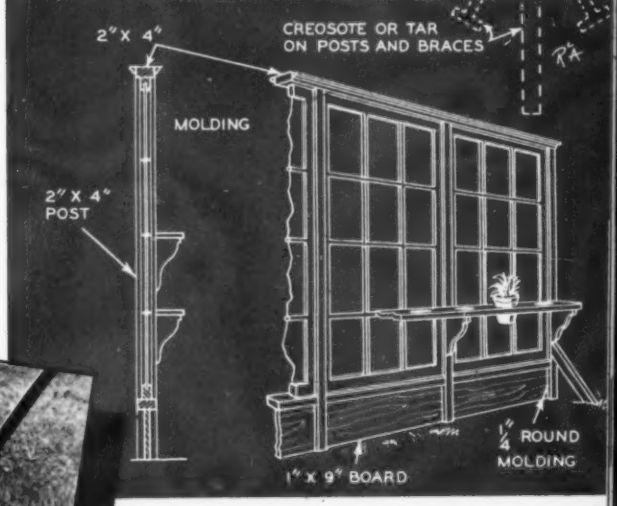
Mechanix Illustrated

GARDEN KINKS



Wind Screen

THE windy days of summer and fall won't chase you indoors from the comfort of your porch or terrace if you have one of these wind screens for protection. Provided with one or more shelves, it will hold pots of flowers for decoration. Obtain sash (preferably the multi-pane type), from a wrecking yard and build the frame to suit. If possible, fasten end to wall.



Lawn-Mower Wheels

FREQUENTLY the wheels on power lawn-mowers become cracked or broken. When this happens, they can be replaced with brake drums from an old car. For traction weld a series of beads on the rim of each drum.

Watering Can

MAKE this Victory garden sprinkler from a large oil can, a tall powder can and a perforated polish can. Curtain rod provides handle.

Military jack-of-all-trades, the half-track has given a good account of itself in every theatre of war in which it has been engaged.

U. S. ARMY HALF-TRACK

Another in MI's series on simple wooden models of famous mechanized military equipment of World War II. It's easy to build and will help round out your model collection.

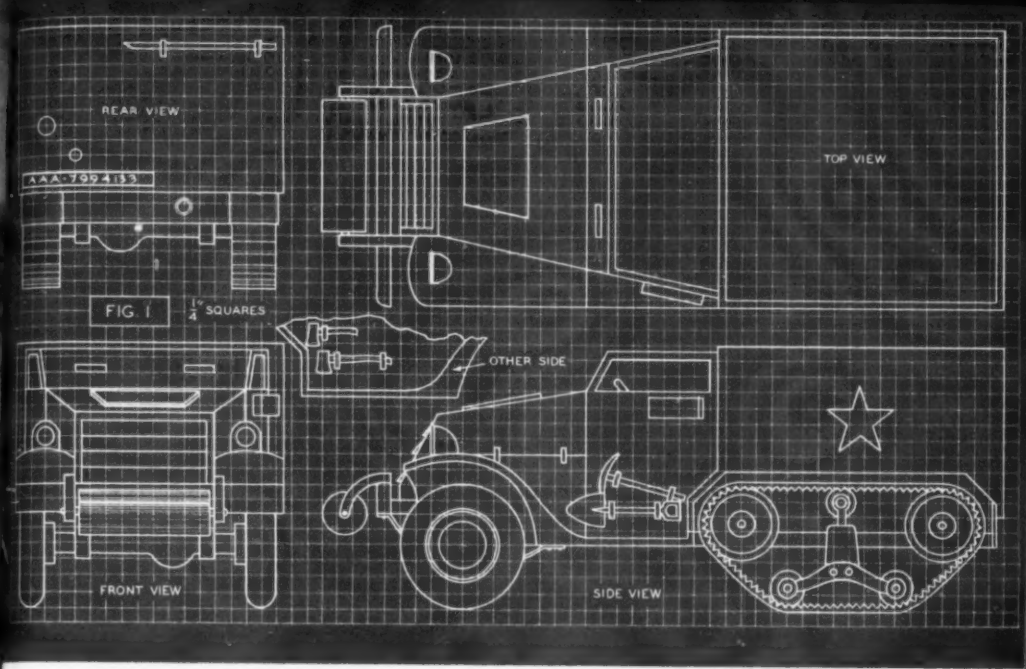
by Hi Sibley

THE sturdy half-track motor vehicle, which can be adapted to many military uses, even to mounting a destructive 75 mm. cannon, is presented here in a modified form—adapted to easy construction and devoid of those tricky and tedious items necessary to an actual scale model. The novice should have no headaches in building this addition to his collection.

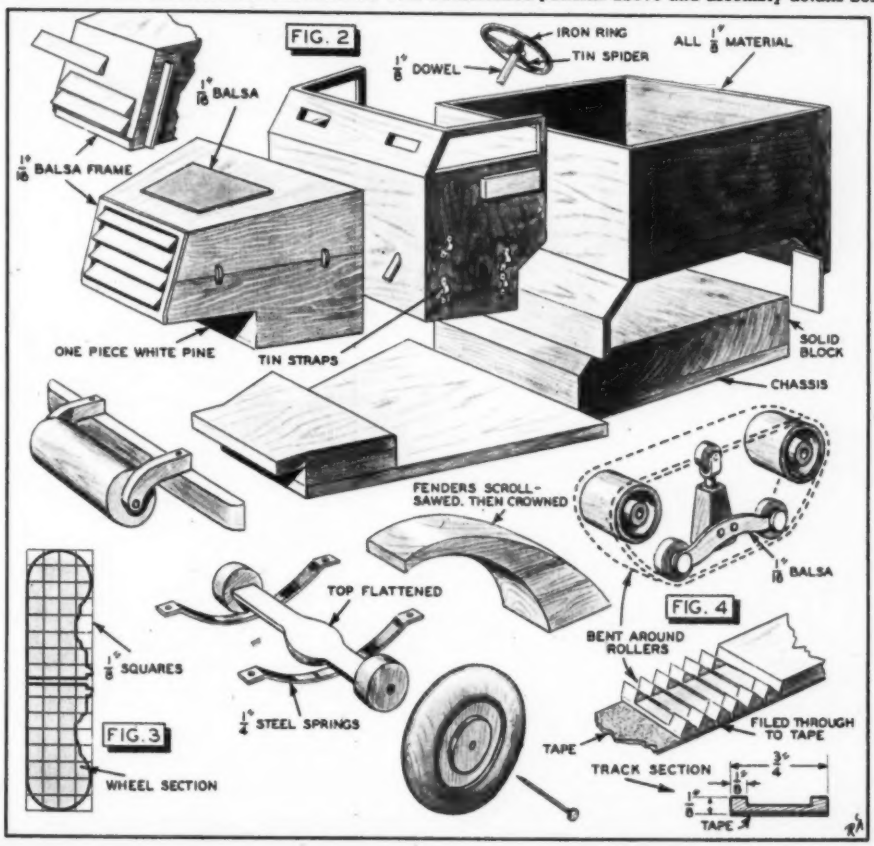
Four views, to scale, are shown in Fig. 1 and you will observe that the track assembly is much lighter than that of a tank, even a light tank. The entire job, however, is armored all over, the armor in this case being white pine painted olive drab. A shovel and pick are strapped to one side of the driver's compartment, a hatchet and an axe on the other and a crow-bar on the rear.

Assembly of the body is shown in Fig. 2 and involves only straight saw cuts. Make the chassis board of ¼" white pine, the filler block and hood of the same material. For louvres over the radiator, glue on triangular strips bordered with a frame of $\frac{1}{16}$" balsa, and install an inspection hatch on top of the same material. Driver's compartment and box body are of ⅛" material assembled with small brads and casein glue. Cellophane and celluloid may be installed in the side frames, and tin straps over the pick, shovel, etc. Steering wheel and post are the same as on preceding models, a tin spider soldered to a wire ring and mounted on a dowel. Fenders are scroll-sawed from 1⅛" white pine and crowned with knife and sandpaper. Two brackets of wood secure the front roller to the straight bumper, and steel springs are carried under the wooden axle, which is flattened on top and nailed to the chassis. Wheels are lathe-turned as in the profile, Fig. 3. Use a close-grained wood for these.

Driving rollers for the track assembly are left smooth. To make the tracks (Fig. 4), a rabbeted strip of white pine about 12" long and ¾" wide is glued to binding tape the same width. Then with a three-cornered file cuts are made, evenly spaced, down to the tape; then it is possible to bend the track around drive-rollers and idlers. However, the track is movable.



Plans for the model half-track are shown here, with dimensioned patterns above and assembly details below.



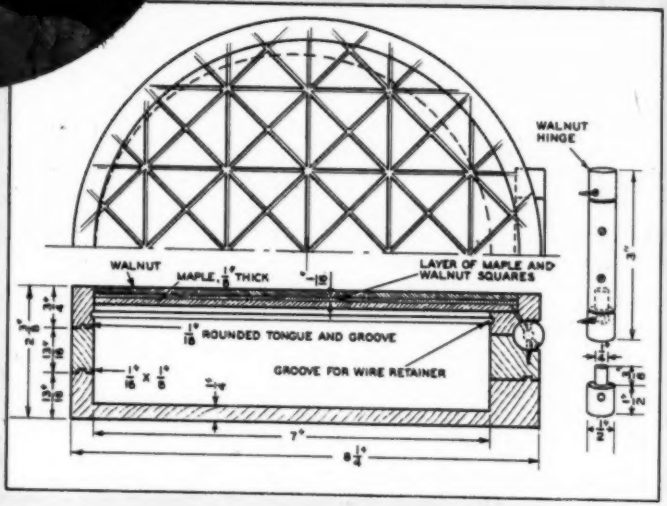
JUMBO COMPACT

HOLDS COSMETICS

Although too large for a lady's purse, this compact is an attractive and practical item for her dressing table.

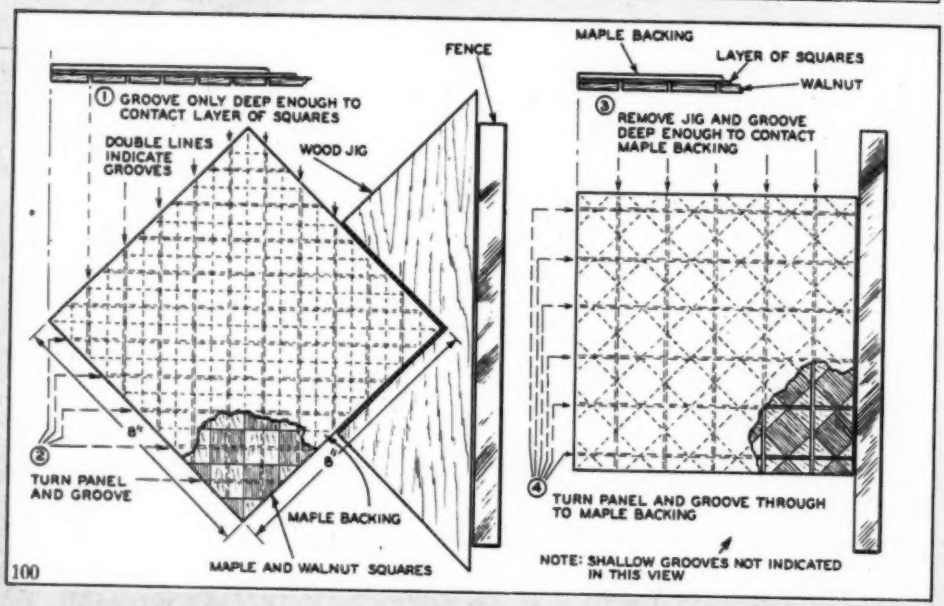
by Benjamin Nielsen

The completed compact is shown at the left. Mirror is held in the cover by a retaining ring in groove.



Side view of compact at right shows the "sandwich" lid and construction details.

Follow closely layout below. Grooves must cross in centers of middle squares.

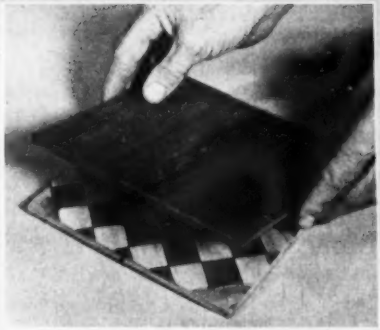

FENCE
MAPLE BACKING
LAYER OF SQUARES
WALNUT
① GROOVE ONLY DEEP ENOUGH TO CONTACT LAYER OF SQUARES
DOUBLE LINES INDICATE GROOVES
WOOD JIG
③ REMOVE JIG AND GROOVE DEEP ENOUGH TO CONTACT MAPLE BACKING
8"
8"
② TURN PANEL AND GROOVE
MAPLE BACKING
MAPLE AND WALNUT SQUARES
④ TURN PANEL AND GROOVE THROUGH TO MAPLE BACKING
NOTE: SHALLOW GROOVES NOT INDICATED IN THIS VIEW

AN UNUSUAL cover design is the feature of this make-up box. Cross grooving of a specially constructed panel in the lid provides the effect. Instead of following the method shown, the surface piece of the lid may be dispensed with, if desired, leaving the checkerboard pattern.

The panel is constructed as shown. A series of maple and walnut squares are glued to a thin piece of maple and a thin top piece of walnut then is glued over the squares. When the glue has dried, the cover is grooved with a saw. Follow the design indicated in the drawing carefully when grooving; some grooves are made deep enough to contact the squares only, while others go right through the squares to the maple backing. Lay out your plan so that the grooves cross in the centers of the squares. The shallow ones should be done first, and the ones running across the grain before those running with the grain. The grooved panel is mounted to a piece of waste stock, mounted in the faceplate of the lathe and turned to the proper diameter to fit the rim of the cover. This waste then can be turned off.

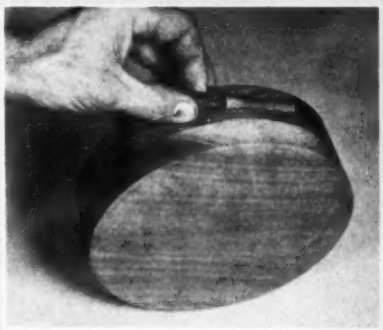
The rim is turned from ¾" stock as shown in drawing; note the offset turning of the inside of the lid rim. This is to provide a thick stock at the rear for the hinge. The inside of the lid is turned with a groove for the mirror retaining ring, and another groove is turned on the face of the rim to fit the tongue ridge on the edge of the box bottom. The grooved lid is glued into the rim. In assembling, the grain of rim and lid should run the same way. Finally, the top is dressed down to leave a walnut layer about 1/32" thick.

The box bottom is turned from 1¾" stock. Offset turning to correspond with the lid is used on the inside of the box body. The lid fastens to the box with a wooden hinge, turned from a walnut stick or dowel, fitted together as shown, and attached with small screws. The box is finished with filler and varnish or shellac. An attractive finish is obtained by rubbing down with No. 4/0 steel wool and waxing. A circular mirror is cut to dimensions and inserted in the lid, and a retaining ring shaped from No. 9 wire is slipped in the groove. If 1¾" stock is not available for the bottom, a suitable piece may be built up from waste stock.

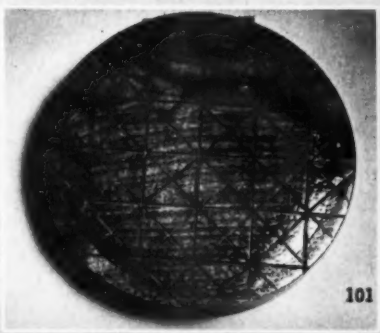


Squares are made of maple and walnut.

Fitting lid (above). Hinge (below) is walnut.



Grooves show the color of squares beneath.



THE SCHOOL SHOP

Conducted by Gilbert Paust

Lieutenant, Civil Air Patrol, Westchester Squadron

Chapter 16—Fronts and Storms

IF YOU were an airline pilot ready to take off on a flight along one of the many airways of the United States, the weather report handed you before your trip might include the statement: POLAR AIR MASS COVERS DISTRICT WITH SUPERIOR AIR ALOFT SOUTHERN PORTION, or the warning: MODERATE COLD FRONT WITH THUNDERSTORMS NEAR CENTRAL STATE. Not much information in these few words, you think, but on the contrary, they serve to round out completely the picture of the weather zone existing along your route. POLAR AIR MASS! COLD FRONT! Let's see how they fit into our story of weather.

Early meteorologists, in their analysis of weather, studied the effects of temperature and pressure upon the atmosphere and its elements, but they neglected to consider one very pertinent factor. They knew all about the winds and turbulence which we have discussed in previous chapters, but they did not realize that the air motions which make up the general circulation of the atmosphere are very complex, and that there are a number of strong air currents which transport large masses of air over the face of the earth. These air masses, moving over land and water areas, take on the temperature and moisture properties of these areas, and carry weather

with them, bestowing it upon new surfaces over which they pass.

Air masses are named for the modern meteorologist, and their weather properties are classified so he can tell the pilot just what to expect when flying through any one of them. Bergeron, a Norwegian scientist, has given us a convenient method for naming them with respect to their sources and temperatures, and his system is used on weather maps throughout the world. This is it!

Air masses originate in the *tropical regions* (T), *polar* regions (P), *arctic* (A) and near the *equator* (E). Those which form high above the earth's surface are called *superior* (S). These five can be classified into two groups: those which form over land surfaces and are called *continental* (c), and those which form over water surfaces and are called *maritime* (m). These, in turn, we can divide still further into air masses which are *warmer* than the surface over which they are passing (w), and air masses which are *colder* than surfaces over which they are passing (k). Putting these symbols together, we can identify an air mass very quickly and easily. For example: when we see the letters cPk on a weather map, we know that they refer

The wise pilot lands his plane when he sees a line squall coming.

The surface between two air masses is called a front. Cold fronts are steeper than warm fronts.

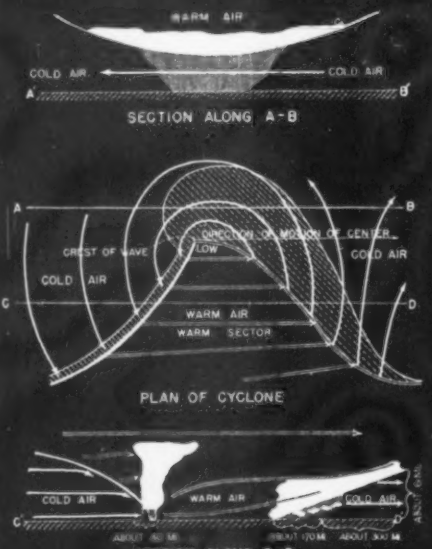
A fast moving cold front causes a line squall as above. Don't attempt to fly through one of these.

Increasing and lowering clouds and rain accompany warm fronts. Upper fronts form as below.

Diagrams Courtesy C. A. A.

The development of a cyclone is similar to that of a water wave. Occluded front is final result.

The word, cyclone, does not mean storm; it means low pressure area. Complete structure is below.



Diagrams Courtesy C. A. A.

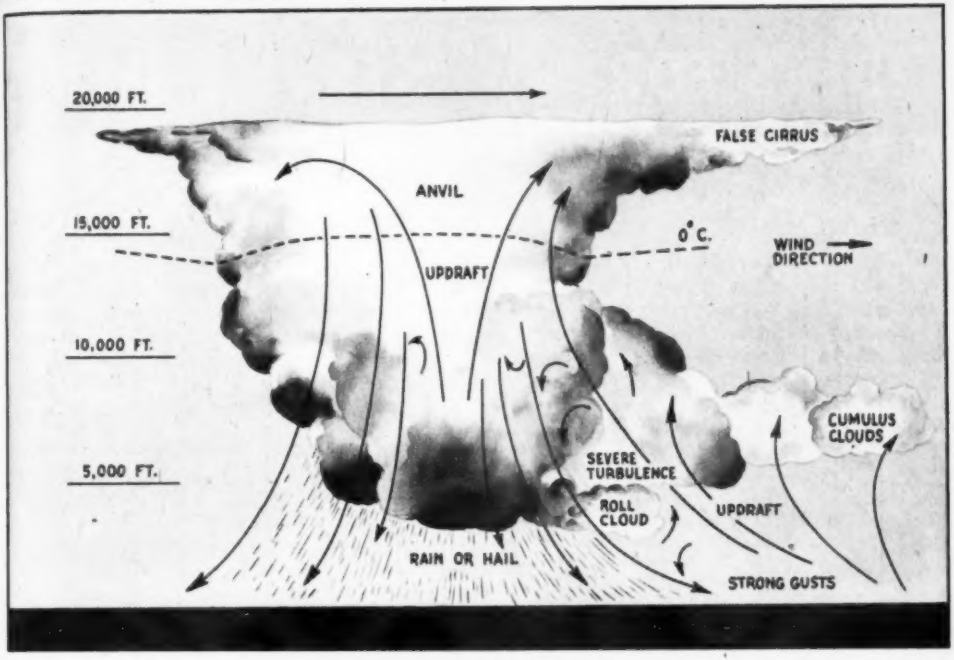
to a polar air mass of land origin which is colder than the surface over which it is passing. Similarly, the letters mTw refer to a tropical air mass of water origin which is warmer than the surface over which it is passing.

A great deal of our bad flying weather occurs at the dividing surface separating two air masses of different temperatures. This surface, incidentally, is known to the pilot as a *front*, and derives it name from the motion of the two air masses it separates. In other words, if a cold air mass is overtaking a warm air mass, the front is a *cold front*; if a warm air mass is overtaking a cold air mass, the front is a *warm front*. In the case of a cold front, the cold, heavy air tends to dig beneath the warm air, throwing it upward just as a snow plow turns up the snow before it. In a warm front, the lighter air overruns the cold air.

Cold fronts offer the most hazardous flying weather. There are two types: the *retarded* or slowly moving variety and the *fast moving* front. In the former, there is a gentle lift and cooling of warm air as the front moves forward, causing the different stratus cloud formations and precipitation, and in some cases cumulonimbus clouds and scattered thunderstorms. When you see a fast moving front coming along, however, don't try to brave it in your light ship; either swing the nose around and get away as fast as you can, or land and tie the ship down. It's a bad actor! The "snow-plow" effect causes a violent lifting of the warm air which results in a continuous belt of thunderstorms about 50 miles wide extending along the entire front. This is called a *line squall*. It passes quickly and you can resume your flight without trouble.

In a warm front, where the warm air flows smoothly over the top of the cold air, the clouds usually are of the stratus type, although altocumulus and cumulonimbus clouds may form if the air is at all unstable (tends to move upward of its own accord because of temperature and pressure differences). With stratiform clouds forming, an area of rain may extend for quite a distance ahead of the front; with cumuliform clouds, heavier rain or snow and showers may take place ahead of the front. Whereas a line squall is the main characteristic of a cold front, increasing and lowering clouds and finally rain, bringing with them zero ceilings and poor visibility, is the weather hazard associated with a warm front.

Mechanix Illustrated Art by Anderson



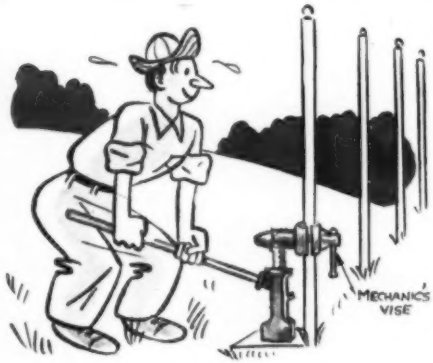
A thermal thunderstorm is formed from a cumulonimbus cloud. Its turbulence and hail are hazards to aircraft.

Cold fronts move in the direction of a cold air mass, and their velocity is the same as the cold wind velocity at 4,000 ft. Warm fronts move a little more than one-half as fast as a cold front, however. When a cold front, moving faster than a warm front, overtakes it and the warm air between them is lifted, the result is an *occluded* front or *occlusion*. Weather conditions in an occluded front [*Continued on page* 138]

Lightning occurs in a storm when raindrops split, leaving an electrostatic charge on the cloud itself.

IDEAS FOR SERVICE MEN

REMOVING METAL FENCE POSTS is a job you may not have to undertake very often, but if you *should* be faced with this tedious problem some time, A/C Ralph T. Kramp of Santa Ana, Calif. has a suggestion to ease your task. He uses an ordinary workshop vise and auto jack to raise the more stubborn posts. Vise is clamped



securely to the post, as shown in the sketch, and the leverage of the jack applied against it. Post will jack out of the ground in a jiffy.

CADET GLENN C. RENNAUX of the South Dakota State College, Brookings, South Dakota, has an idea that should interest Army cooks, or any stew jockey, for that matter. Says Glenn: "I used to be a cook before I was transferred to college, and one of the most difficult things I ever tried to do is rolling sausage into patties. You see, the trouble is that after you've rolled several pounds the fat in the sausage starts sticking to your hands. There is a very simple remedy for this. Just get some real cold water and set it beside you. Dip your hands in the water about every two or three minutes. It works like magic. The sausage just won't stick while your hands have that cold water on them."

"Dear Sirs:

I just finished reading your 'Ideas For Service Men' and I think it's very useful for us soldiers. I have found while in training here at Camp Wolters that it was rather hard to keep track of who I received letters from and whether or not I had answered them lately. So I devised a form by means of which I keep my correspondence straight and up to the minute. I have enclosed a copy (illustrated) of this method and hope it proves of value to others in the Service.

Thank you"

Pvt. Joseph Martinus
Camp Wolters, Texas

HERE'S ONE from Cpl. Darrell Roberts, Flora, Mississippi: "Fanciest wrinkle I've seen lately is a tiny celluloid disc that may be glued on the crystal of your watch. Numbers painted in a circle on the disc range from 13 to 24, with 13 opposite one o'clock on the original dial, 24 opposite twelve o'clock, etc., thus giving Army time at a glance."

This certainly is a neat gadget and one a lot of you boys could make yourselves.—Ed.

BACK AGAIN with us this month is the old controversy—just what really is the best method to dry off a mess hall table after washing? We've had exponents of the burlap bag method, and the squeegee method expound their ideas, and now up pops Pvt. Robert I. Hodgins, Keesler Field, Mississippi with still another scheme, which he claims is infallible.

We'll let him tell you about it in his own words:

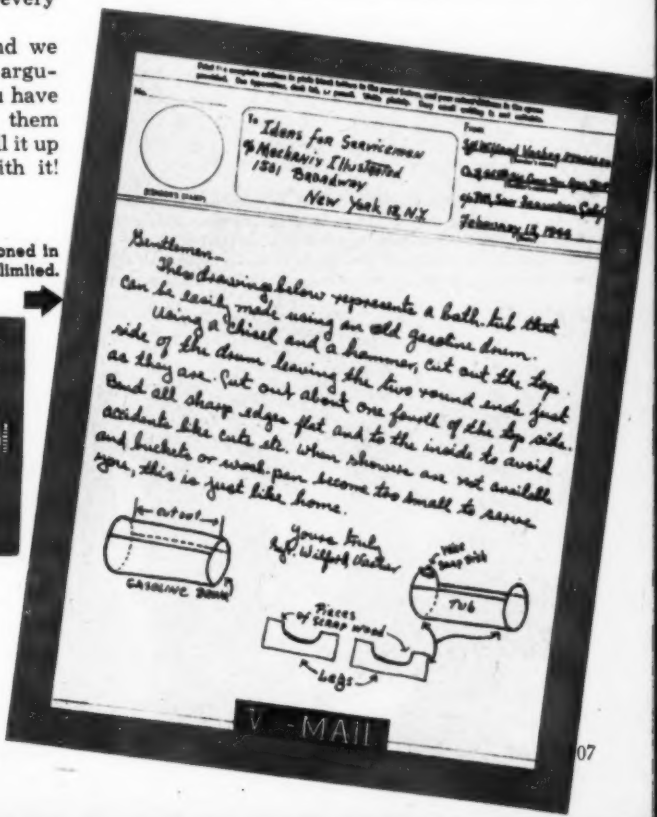
"A great percentage of the mess halls do not furnish squeegees, but I have an idea that works on the same principle. It involves the use of one of the four folding flaps that make up the top or bottom of one of the many cardboard boxes found in the average mess hall. Tear off the flap and push the straight edge in a sweeping motion across the table. It will clean off the excess water as well as a real squeegee, and if it only lasts for two or three swabbings, what's the difference? You have eight potential squeegees on every carton."

This winds us up for now, and we hope winds up the table drying argument forever. If any more of you have ideas on the subject, just write them down on a large piece of paper, roll it up and wipe a couple of tables with it!

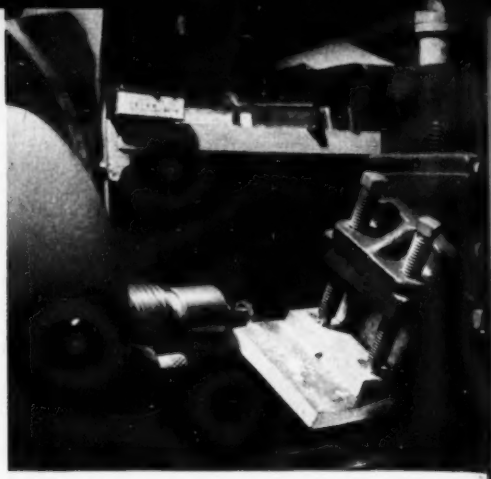
SERVICE MEN, ATTENTION!

This is your department, and if you like it enough to want to make it better, you can. It's all up to you! Send in your ideas—anything you think may help your buddies in the Army, Navy or Marines. You'll be helping yourself too, because MECHANIX ILLUSTRATED pays from $2.50 up for material used. Address "Ideas for Service Men," MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, N. Y.

At right is a little idea for soldiers stationed in areas where bathing facilities are limited.


To Ideas for Servicemen
% Mechanix Illustrated
1501 Broadway
New York 18, N.Y.
February 15, 1944
Gentlemen—
Can be easily made using an old gasoline drum.
Using a chisel and a hammer, cut out the top side of the drum leaving the two round ends just as they are. Cut out about one fourth of the top side. Bend all sharp edges flat and to the inside to avoid accidents like cuts etc. When showers are not available and buckets or wash pans become too small to serve, this is just like home.
GASOLINE DRUM
TUB
PIECES of SCRAP wood
Legs
V-MAIL

The piece of plastic is clamped into the milling attachment vise of a small precision lathe. Keyway milling cutter (1/8"x1/8") has been inserted into a collet in the head stock of the lathe. It is important to remember that the lathe should run no faster than 800 revolutions per minute on direct drive for best results.



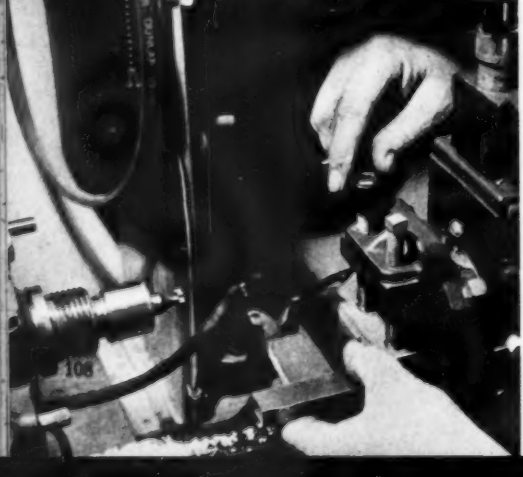
It is possible to make cuts at any angle by adjusting the milling attachment as shown in this picture. Even double angles can be cut if the attachment itself is set at an angle against the compound rest. Greater care should be taken with this kind of set up than in straight milling as plastics are brittle at angle edges.

MILLING PLASTICS

IT IS possible to mill plastics such as Catalin, Plexiglas, Lucite, or Acetates like Lumarith in attachments for both the lathe and the drill press. Milling attachments are not usually found in the average home workshop; perhaps because they are somewhat expensive adjuncts to the ordinary run of tools. When you consider, however, how many unusual jobs you can do with these attachments, you will realize that they are an investment well worth while.

The beauty of milling plastics lies in the fact that no cutting oils are needed and that with proper care you can do extremely accurate and smooth work on a wide scale. Catalin, Lucite, Plexiglas, etc., may be

This picture shows how a piece of plastic is set squarely into the jaw of the milling attachment. Hold your toolmaker's square firmly against the jaw, which has been tapped against the back of the attachment and tap piece itself to the same angle as square.



We now have cut two square edges, and applying a toolmaker's square against them we see that everything is "right on the button." A proud moment, indeed, because any time we can make a real square in plastics, we know that we are good craftsmen.

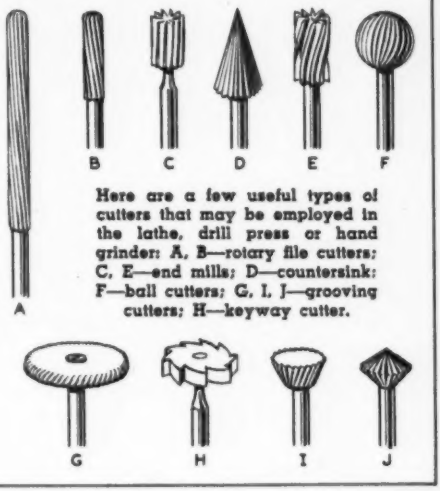
by Josephine von Miklos

worked at a fair speed. Acetates like Lumarith and Tenite must be dealt with more carefully because they burn easily, but in any case you will find that you are able to polish milled surfaces with a great deal less difficulty than a piece filed, sandpapered or turned on a lathe.

With a selection of proper milling tools, keyway cutters, end mills, rotary files and sometimes even small sand and grinding wheels, you will be able to cut accurate grooves, edges, and if you are particularly skilled, even curves although they usually require special tools.

Even more care is required when you use a milling attachment on your drill press as shown in one of the photos. Again you must run your press at a slow speed and take small cuts. If your tool is very small, it tends to bend or even break unless you take it easy. It is entirely possible to use an ordinary drill for milling in a drill press milling attachment for fluting. The milling attachment used has a V-jaw so that a round piece can be held firmly. You will do well, however, to lay out your rod carefully before inserting it and check your position each time so that you may be able to get a regular pattern. If you want to polish the inside of a groove or flute after it has been cut on a drill press milling attachment, it will be well to use first one of the felt or rubber buffing wheels provided with some of the hand grinding tools; they will clean the chips off the surface. Final polishing then can be done in the regular way with the ordinary cloth buffing wheel. The smaller the groove, the more difficult the polishing operation, and the more necessary the removal of chips.

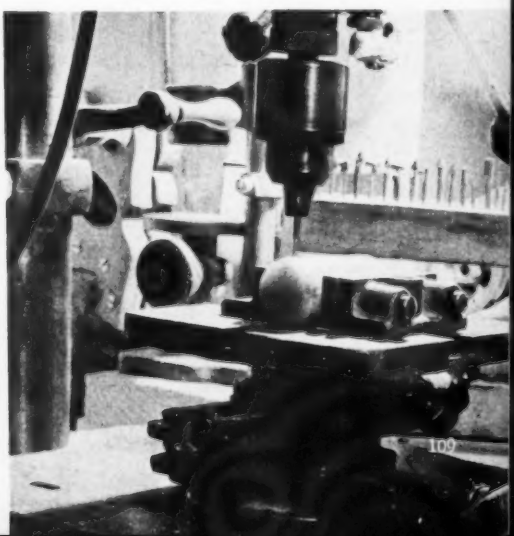
By using either of the methods described, you will be able to build a variety of items made of plastic and give them a fit usually not found within the realm of ordinary machining processes. Milling of edges and grooves eases bench work and aids precision.



Here are a few useful types of cutters that may be employed in the lathe, drill press or hand grinder: A, B—rotary file cutters; C, E—end mills; D—countersink; F—ball cutters; G, I, J—grooving cutters; H—keyway cutter.

Small drills, grinding wheels, rotary files, etc., are widely used in high speed hand grinder tools or carving tools with flexible shafts. See if you can tell just what tool is being chosen out of the rack for the job that is shown in the next photograph.

Here we are with a special milling attachment screwed on to the drill press. A round piece of plastic is clamped into the jaws of the attachment for grooving. What we are milling with, is a common dentist's drill.



Bearings for Victory

Steel races and balls are carefully heat-treated.

Bearings enable tool below to turn at 75,000 r.p.m.

The story of the manufacture of bearings and their precision tests is told in this second and final installment.

by Bertram Brownold

PART II

BALL and roller bearings are carefully designed and are machined with the utmost precision. The most interesting part of the assembly is the ball itself, and so we'll consider their production first.

Cylindrical steel bar stock, wire or rod of suitable diameter is fed into huge cutting machines, the hard steel jaws of which shear it into short lengths called "slugs." The diameter of the stock, of course, bears a relation to the size of the finished balls, and the steel in the bar stock, rod or wire is manufactured according to the most exacting specifications. Before being used it is subjected to the most rigid tests that science can devise.

Balls are made in stock sizes ranging from $\frac{1}{16}$" in diameter up to $1\frac{1}{2}$"; larger balls are made to order. First the slugs are fed into powerful presses. The jaws of the press are fitted with a hard steel die, each die being a

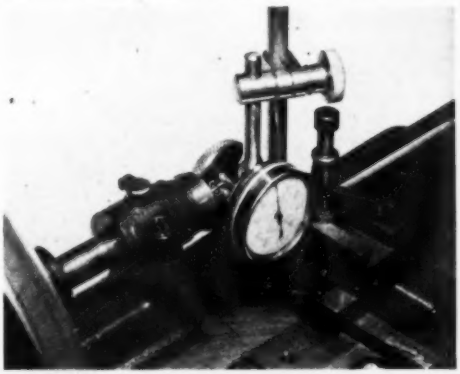
"Miking" the inner surface of the race to guarantee precision.

Photos Courtesy of SKF Industries, New Departure and Miniature Precision Bearings

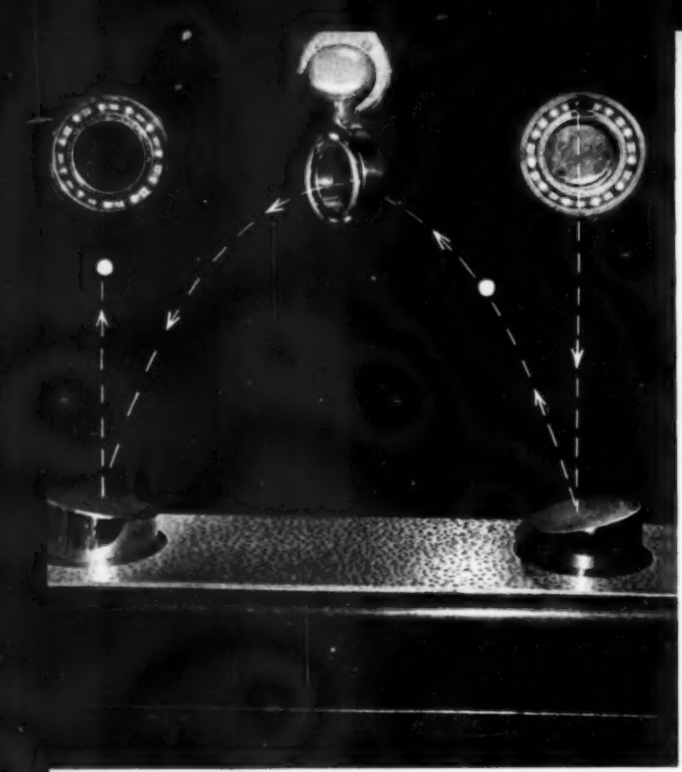
hemispherical cup. The slug stands vertically in the lower cup, the jaws come together with terrific force and a rough steel ball is produced. This process can be performed "cold" on bar stock less than 1" in diameter, but for larger sizes the slugs first must be heated in furnaces. This ball that is thus produced is quite different than the highly polished steel sphere it ultimately will become. It has many imperfections, and around its middle is a belt of excess metal that has been squeezed out from the lips of the upper and lower dies. This strip is in the same relative position on the ball as the equator about the earth.

Next this belt of excess metal is removed and the balls are rough-ground between rotating disks of steel. The disks are horizontal, and they are not unlike the upper and lower millstones of an old-fashioned flour mill. After the first rough grinding, the balls are heated in furnaces and then tempered and hardened by quenching in an oil bath. The purpose of the hardening is to make the balls hard through and through and not simply to give them an outer hard shell or case. Next the balls are fed to another grinder, finer than the first one, and from this to still another until all the grinding processes have been completed and the balls are ready for tumbling. The various grinders are all similar

Machine checks complete bearing for concentricity.



Balls are examined carefully for surface defects.



In this "bounce" test, each ball bounces from an inclined plate through a rotating ring to another plate and then into a hole.

in principal, differing only in such details as speed of revolution, direction, the type of oils and abrasive compounds used on the balls during the grinding process, and the degree of pressure exerted between the two grinding faces. The balls, during all of this grinding, are rolling, of course, but they are continually changing the direction of their rolls, and also continually changing their axes of rotation. The result is that they gradually assume the shape of perfect spheres.

After the grinding comes the tumbling and lapping processes. In the tumbling process the balls are poured into huge steel drums or barrels which rotate, tumbling the balls in their interiors. The balls tumble in a sort of slush compound of fine abrasive sand and liquid chemicals. This takes from thirty to forty hours, and sometimes is divided into two stages. In the first stage the sandy slush is used and in the latter stage the balls are tumbled dry but are mixed with quantities of chopped-up soft scrap leather which polishes them. Lapping is a refinement of grinding. It is such very fine grinding that it is hardly more than polishing, however. It is carried out just as is the grinding, between steel plates one of which usually is stationery while the other rotates. A special lapping compound, carrying an exceedingly fine abrasive, is used between the plates. Believe it or not, when lapping has been completed, the balls are true for size and sphericity to within twenty-five millionths of an inch (.000025").

All through the processes so far described, a parallel process of testing and gauging runs concurrently, synchronized with the various manufacturing steps. These tests are in themselves so interesting that a brief word about them may be in order. One test for size is to run the balls along a slot the sides of which diverge gradually. As the balls roll along, they drop through the slot as soon as they reach the proper width, and below the slot are a series of numbered steel boxes into which the balls fall. Another size test is to place the balls on a succession of rotating circular steel plates having precision-drilled holes of the desired size. This sorting process permits only balls of one size to drop through each plate.

The gauging and testing, incidentally, are carried on in rooms with the temperature accurately controlled so that expansion and contraction of the metal due to temperature changes will not occur. Where it is necessary to handle the steel balls, the operatives must wear gloves so that the ultra-precise product will not be affected by heat from the hands nor be stained or rusted by perspiration.

The test for hardness and toughness is an interesting one. Out of each batch of finished balls a certain quantity, determined by weight, is scooped up at random. These are fed into testing presses capable of exerting a pressure of hundreds of tons. If a predetermined percentage of the balls fails to stand up to the test, a faulty or too-coarse steel structure is indicated and the entire batch is scrapped.

One of the tests for sphericity, known as the "bounce test," is probably the most ingenious and interesting of all to watch. The balls are dropped on a circular steel plate which is tilted at an angle. They strike the center of the plate and bounce almost as high

as the point from which they were dropped, and then enter a circular hole in the vertical face of a container. The hole has a diameter only slightly greater than that of the ball itself. So perfectly are all factors of bounce, angle and arc calculated that most of the balls pop into the hole with a regularity which is startling. Those few balls which are imperfect do not bounce true, miss the hole and so do not enter the container; they roll down a little channel and are rejected. Sometimes this testing device is so arranged that the balls must make several bounces on a succession of steel plates before entering the hole. At the apex of each bounce, the ball passes through a steel ring which is revolving on a vertical axis.

The race members are produced by the same combination of mass methods and precision work. They are turned, ground, polished, and lapped with the same care, and the testing and gauging processes are just as exacting as those already described. One of the tests involves powerful lights and lenses by means of which a huge, magnified image of the race is thrown on a screen. Imperfections, if any, are thus made visible. The cutting of the race ways or grooves is a matter that has been reduced to a special science and separate formulae and tables have been devised governing their dimensions.

Thirteen separate operations are required to shape the inner ring, but twenty-three inspections are needed before it can be assembled into a bearing. Recent advances in the manufacture of ball-bearing steel have made it possible to grind the grooves to a smoothness of two millionths of an inch (.000002″). Such bearings actually will turn when breathed upon.

Sheffield-gauging the o.d. of a deep-groove ball bearing (above). Girls are skilled in checking the unusually close measurements.

Well-trained inspectors check uniformity of each bearing before passing it.

DECORATIVE WALLCASE

Not only a handy convenience, this case is well designed and will add a pleasing, ornamental touch to your room. Use a finish to harmonize with the color scheme of your walls or furniture.

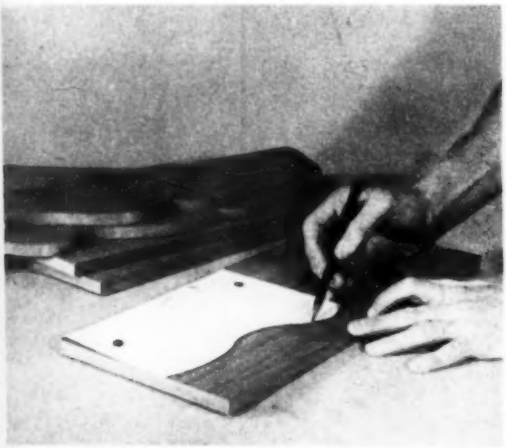
This finished model was made of Mexican mahogany.

THIS project is a particularly rewarding one for the home craftsman; in exchange for very little effort, he can have a piece of furniture which is impressive in appearance as well as extremely useful. Use any lumber available and convert the dimensions shown on page 115 to those which will suit your wall space. This can be accomplished by substituting smaller or larger squares for the ones given.

Pieces are cut from cardboard templates made according to the drawing. These can be thumbtacked to the wood on sides which will not show in the finished piece, and held with adhesive tape on the good sides. The curves can be transferred to the wood with a pencil, or the templates can be left in place and the work run through the jig that way.

After the templates are made, they should be used first for locating the dado grooves; these should be cut before cutting the curves for it is easier to handle the work when it is still square. It is important to have the dadoes good and tight so that the work will be strong after gluing. If the cutting is done with a dado-cutter on a circular saw, and if the cutter does not provide a really tight fit, remove one of the chippers and space out the remaining ones with washers cut from shim or light sheet metal. After the sides and shelves are cut, rabbet the back edges of the sides at top and bottom to accommodate the two back pieces.

When gluing the shelves into the side



Pieces are cut from templates, thumbtacked to wood.

Apply two coats of glue to grooves: one as filler.

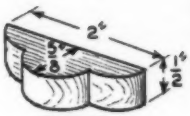


FIG. 3

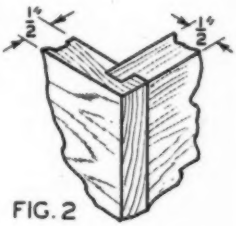


FIG. 2

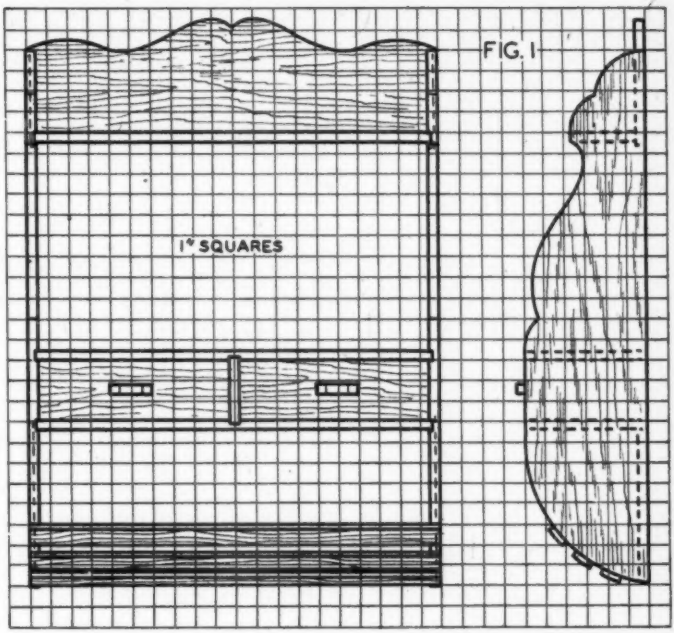
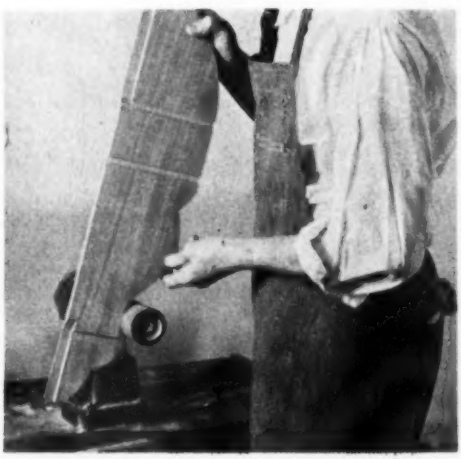


FIG. 1

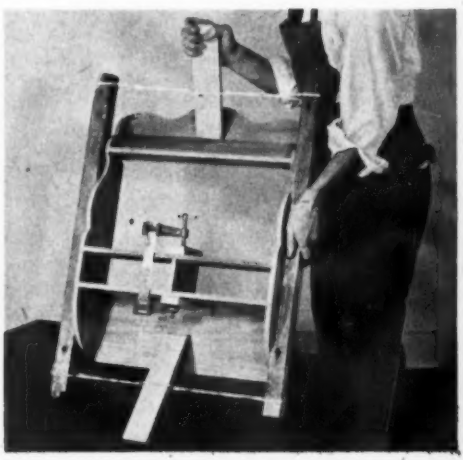
Change size of squares to fit wallcase size required.

pieces, pressure can be applied by means of two scrap pieces of wood of suitable size and two "tourniquets" of rope as shown. The pieces of scrap wood should be thick and strong enough not to bend when the rope is twisted.

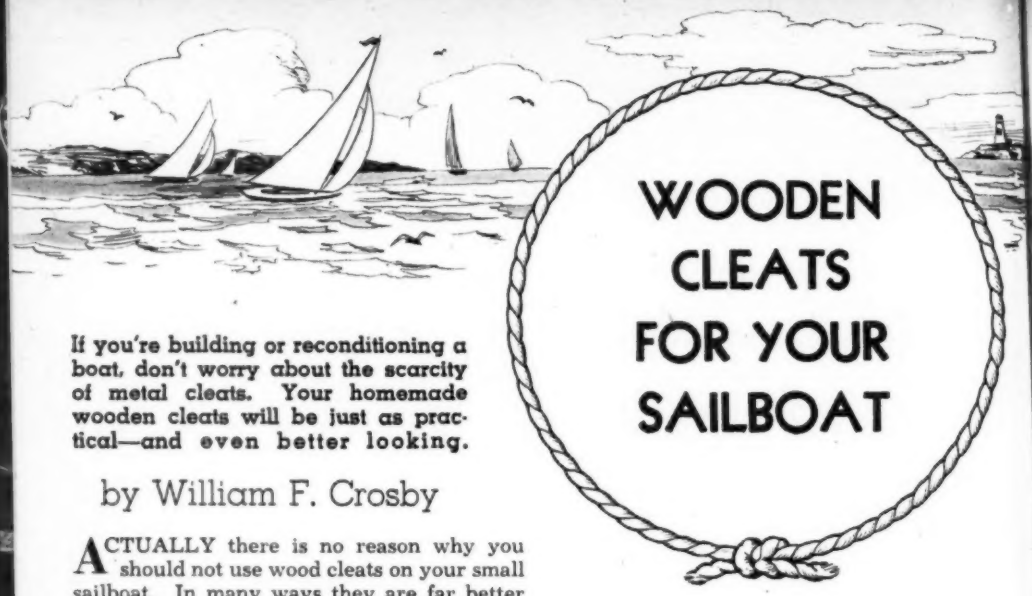
The sides of the drawers are rabbeted and glued into the fronts and backs, and the drawer bottoms (of ⅛" plywood) are dadoed into the fronts, backs and sides. Below the shelves is a space for potted plants. Wooden slats pegged and glued to the curves of the vertical sidepieces hold the pots in a position that tilts them forward slightly and permits the foliage of the plants to hang over or through the slats. There must be enough space between the bottom shelf and the topmost slat so that the flower pots can be inserted, of course. Hang the case by means of two square hooks set in the wall.



Use drum sander for concave curves; disk for convex.



Scrap wood and "tourniquets" hold pieces for gluing.



WOODEN CLEATS FOR YOUR SAILBOAT

If you're building or reconditioning a boat, don't worry about the scarcity of metal cleats. Your homemade wooden cleats will be just as practical—and even better looking.

by William F. Crosby

ACTUALLY there is no reason why you should not use wood cleats on your small sailboat. In many ways they are far better than the ordinary metal cleat, as each may be adapted to its own particular need. For small racing boats, the use of proper cleats may save just enough time to win races and for this reason they are coming into more widespread use all the time.

Roughly, they may be divided into three different categories: the jam type, half-jam and non-jam. Each will be found useful. They may be made from almost any kind of hardwood, but teak, oak and locust are the preferred materials. They are sawn to rough shape and then carved and filed to the final dimensions. If sanded down and varnished, they will present a far neater appearance than the usual corroded brass or rusty galvanized iron cleat. The dimensions on the drawings are for the smallest practical sizes and are for use on boats such as Moths, Snipes, Comets, etc. For larger boats they should be made correspondingly larger.

Figure 1 shows a combination cleat half of which is jam and half of which is non-jam. It has widespread uses, one of which is shown in Figure 2. In this case it is used for hauling down the tack of the sail in order to tighten the luff. The cleat is screwed or bolted to the mast at a point near the deck and directly below the track. In this case the jam part of the cleat is uppermost so that you may take a turn around the non-jam part, press down on the boom and at the same time hold the turn around the non-jam part. When stretched sufficiently, the line is then brought up and over through the jam part of the cleat and pressed home, making a tight fit which will hold indefinitely. If you want to be doubly sure, you can go around the cleat again with the line.

Of course, it is necessary to use a sliding gooseneck with a rig of this type and the luff of the sail may be made far tighter this way than by the older method of "sweating" up on the halliard. In fact, many small race boats are now eliminating the mast head halliard sheave altogether, using simply a hole for the halliard to pass through. The sail is hoisted easily enough by this method, the halliard then made fast, with the final tightening up being done with the downhaul on the sliding gooseneck. This saves the weight of the sheave aloft and helps to make the boat more stable.

In Figure 3 we have the simplest form of wood jam cleat. It is particularly good for handling the main sheet, as a half turn under one of the horns of the cleat will hold it sufficiently. It also has the big advantage that if the boat receives a sudden knock-down, all the skipper has to do is simply pull out the line and the sail is free. What causes most small sail boats to capsize is the fact that the skipper can't let the main sheet go quickly enough, being forced to unwind several turns from around the usual type of metal cleat. In this particular cleat, passing the sheet under any part of the cleat will hold it securely but if there is more strain on the sheet, you can go around once more with the line thus making it secure. The [*Continued on page* 138]

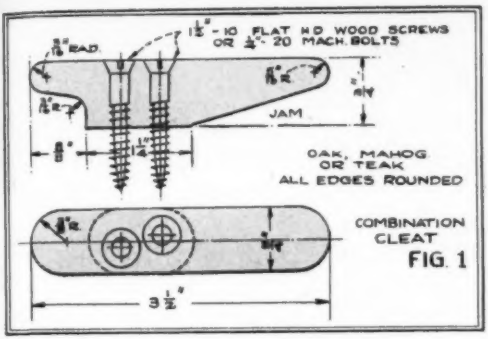


FIG. 1

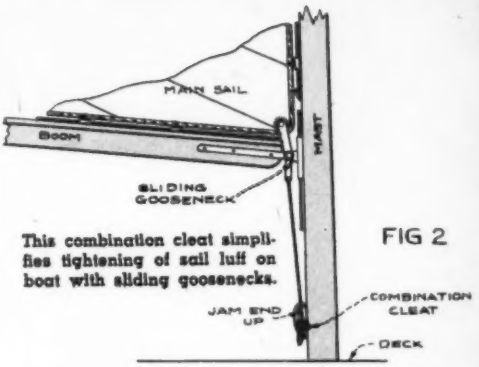


FIG 2

This combination cleat simplifies tightening of sail luff on boat with sliding goosenecks.

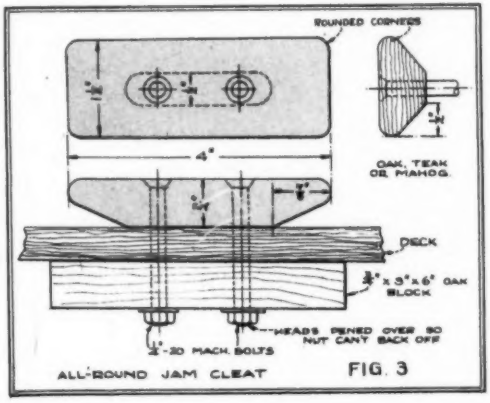


FIG. 3

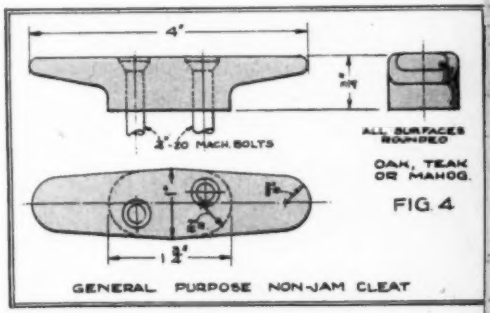


FIG. 4

These drawings show details of two sturdy wooden cleats: one jam type and one conventional cleat.

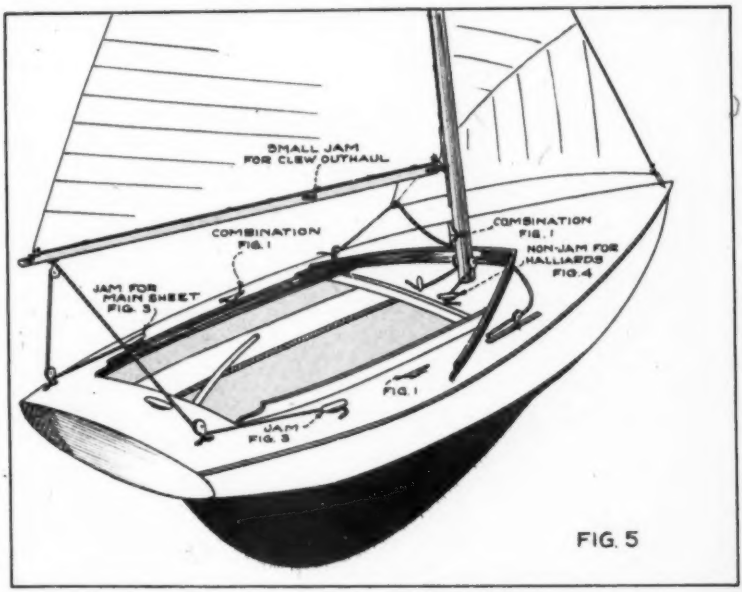
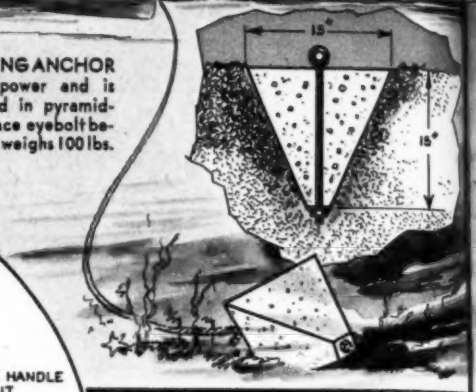


FIG. 5

Suggested cleat arrangement for small racing sailboat of Snipe, Moth or Comet Class, etc. Note small jam cleat for clew outhaul located well inboard on the boom, where it can be reached in any sail position.

SHIPSHAPERS

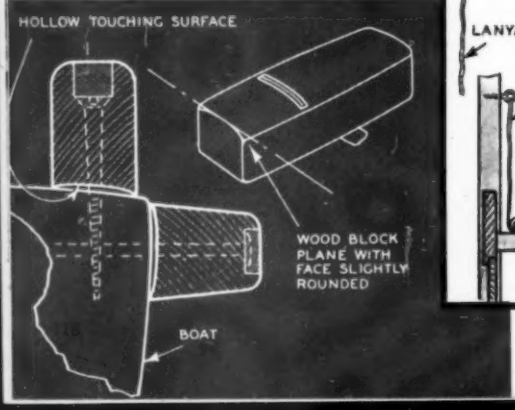
CONCRETE MOORING ANCHOR has great holding power and is easily cast in ground in pyramid-shaped "foxhole." Place eyebolt before pouring. This size weighs 100 lbs.

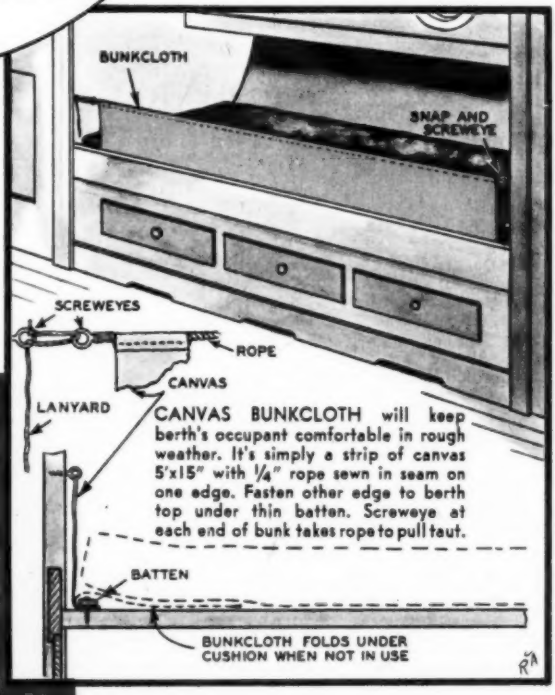


SHAPE HANDLE TO SUIT
GALVANIZED IRON OR COPPER DISC — EDGES MILLED WITH FILE
REVERSE SIDE SPACED FOR "1200" SERIES OR TO 16 MILES
"500" SERIES
0
5 1/16"
RIVET

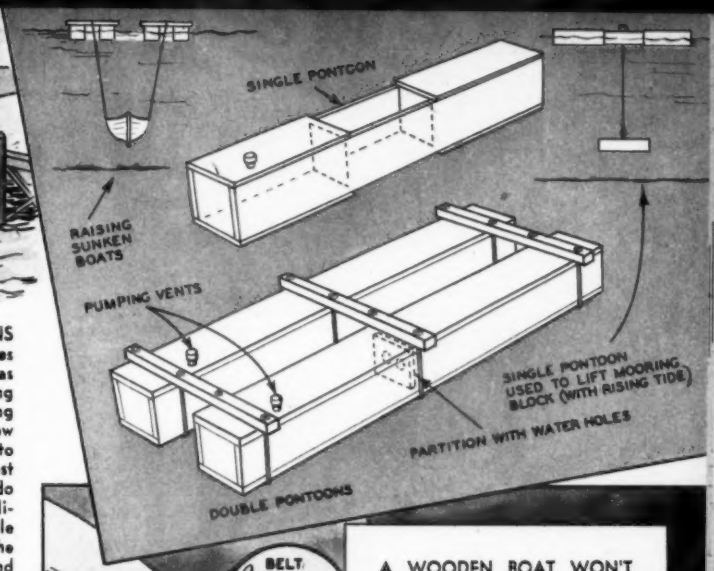
THIS SIMPLE INSTRUMENT makes it easy to measure distances on a chart. Cut a 5⅛" dia. disc of sheet metal. Roll this along the scale of a "500" series chart and mark off the miles on the disc. Gradually file down diameter until miles come out even, as shown, leaving disc about 5 1/16" dia. Mark mile points with file and letter in numerals, then with a small file mill edges like a coin's. Drill hole in center and attach wood handle, leaving enough play for disc to turn. Measurer is simply rolled over chart to determine any distance desired.

ONE SECRET of the professional boat builder's perfect joints is the hollowing of the touching surface of the member being fitted. The guard and toe-rail sections shown below are examples of this (hollowing exaggerated). Touching surface of the member being fastened has been hollowed slightly to allow both its edges to hug the wood; professionals hollow even the touching surfaces of the entire keel and deadwood assembly, scarf joints, and so on, finally fastening members over a coating of thick paint or liquid marine glue.





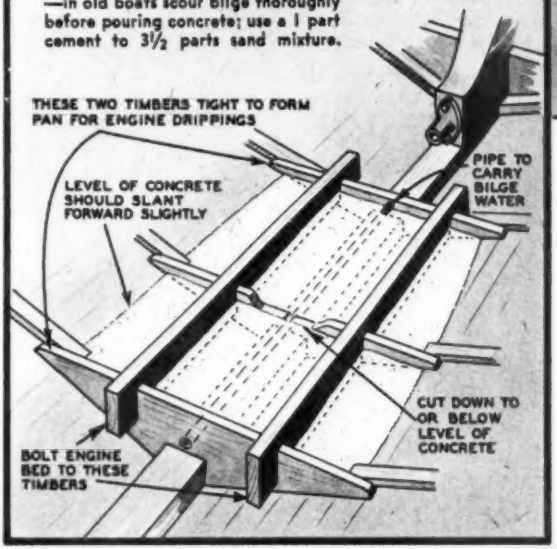
CANVAS BUNKCLOTH will keep berth's occupant comfortable in rough weather. It's simply a strip of canvas 5'x15" with ¼" rope sewn in seam on one edge. Fasten other edge to berth top under thin batten. Screweye at each end of bunk takes rope to pull taut.

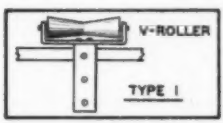


EVERY GROUP OF BOATING FANS or yacht club has a multitude of uses for general utility pontoons such as pictured above and at right. Lifting boat mooring blocks, buoy mooring blocks, sunken boats; these are a few common uses. Another purpose is to support a landing float. Being almost entirely of wood, the pontoons do not rust and deteriorate like the ordinary metal gasoline barrels. The double pontoons have more stability than the single ones, but each type is found very good at its particular job. Pumping vents are provided, which are almost unnecessary after the planks have swelled tight. To preserve the pontoons, creosote the wood, and paint the metal parts heavily. The completed pontoon units will outlast by far the average steel drum type. Construction details are shown, but dimensions depend on your needs, and can be made to suit.

A WOODEN BOAT WON'T SINK if capsized, but its bottom may not offer much handhold to anyone who has to cling to it for support until help arrives. A safety precaution worth taking, even though the need for it may never arise, is to cut a 1½"x5" slot in the boat's skeg or keel to act as a handgrip for the crew in the water.

IN THE AVERAGE BOAT there is not always space beneath the engine to fit a drip pan, but in almost any boat concrete can be bedded there for the same purpose—to keep the bilge clean and safe. This is best done in new boats with the wood bare and clean —in old boats scour bilge thoroughly before pouring concrete; use a 1 part cement to 3½ parts sand mixture.


THESE TWO TIMBERS TIGHT TO FORM PAN FOR ENGINE DRIPPINGS
LEVEL OF CONCRETE SHOULD SLANT FORWARD SLIGHTLY
PIPE TO CARRY BILGE WATER
CUT DOWN TO OR BELOW LEVEL OF CONCRETE
BOLT ENGINE BED TO THESE TIMBERS

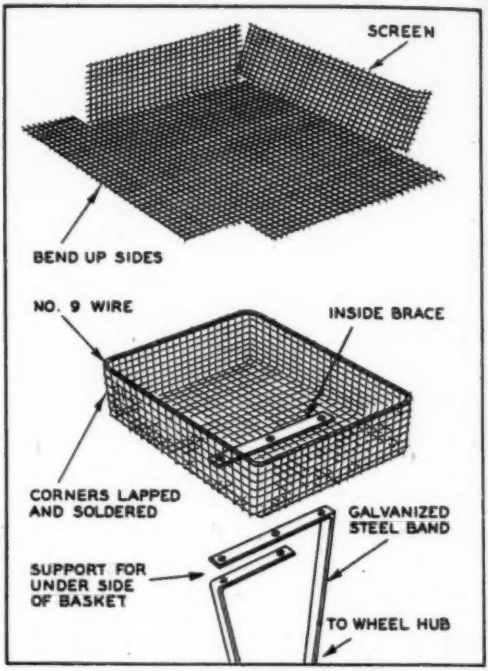


SIMPLE WOOD ROLLERS installed along the gunwales of a work or fishing boat at the most used points will save wear and tear on the latter from constant hauling up of lines.

BIKE KINKS

Package Basket

A SATISFACTORY metal basket for your bicycle can be made of hail screen with a mesh of ½" or smaller. Cut and bend as shown and reinforce top with No. 9 wire, soldered at ends. Basket is fastened to bike by two arms attached to hub and bolted to brace in basket.

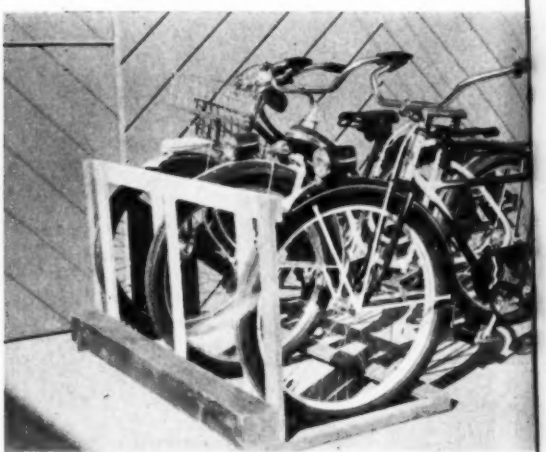


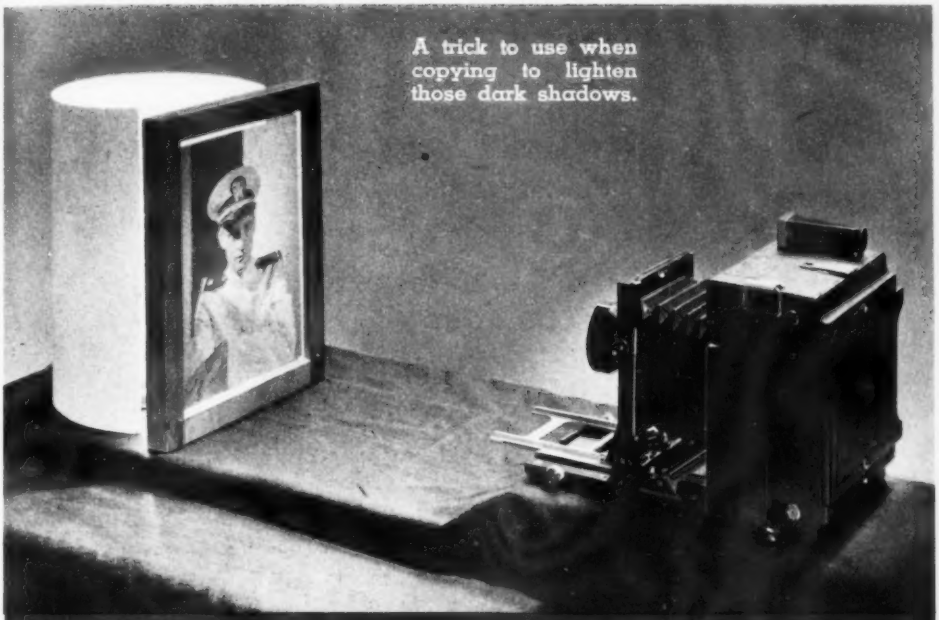
Parking Rack

MAKE this rack of scrap pieces. It is 5′ long, 2′ wide and 2′ high. Distance between bikes is slightly less than 2½′. Use 4"x4" for base support.

Bicycle Speedometer

THE bicycle speedometer shown at the left was converted from an old automobile speedometer. It needed no changes except for the addition of a suitable mounting bracket. The disk turning the cable is a piece of composition board fastened to the spokes with small bolts. The ratio of disk to cable wheel is 2:1. Spring wire keeps them in contact.





A trick to use when copying to lighten those dark shadows.

BACK-LIGHTING for COPYING

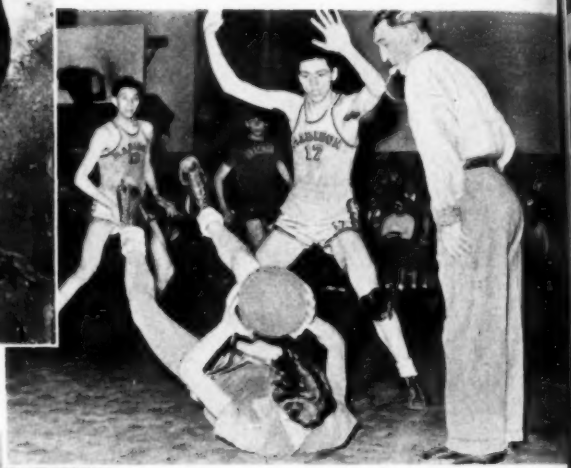
by Lionel Wurts

SOMETIMES a photographer is confronted with the problem of copying a print which shows too much contrast with lack of detail in the shadows. This may be a portrait of a friend overseas, or it may be a picture which lacks tone quality and thereby misses the salon class. Such prints can be improved greatly by the method described here.

First hold the print up to the window or lamp and notice how the back-lighting lightens the shadows. That's the trick we'll use! Place the print between two pieces of glass and bind the edges with Scotch tape. This will keep the heat of the back [*Continued on page* 134]

PHOTO CONTEST

FIRST PRIZE ($10.00): So Tired, by J. P. Whiskeman, Jr., of Kirkwood, Mo.; taken with an Ikoflex. SECOND PRIZE ($5.00): Ball Game, by Leon Shapiro of Brooklyn, N. Y.; taken with a Pressmar. THIRD PRIZE ($4.00): I Dood It, by Martin Wolfersberger of Jersey City, N. J. FOURTH PRIZE ($3.00): Death, by N. Sarandes of New York City.



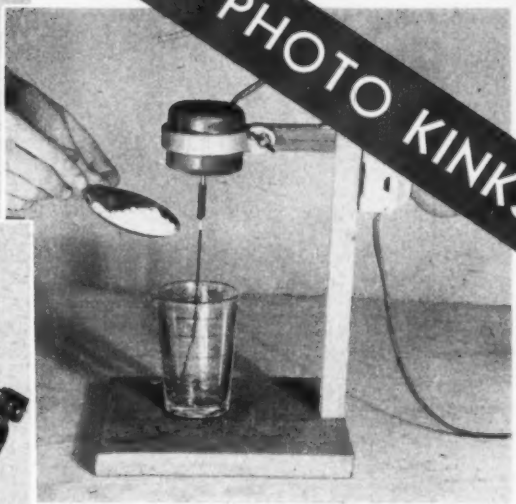
1st PRIZE **2nd PRIZE**

3rd PRIZE **4th PRIZE**

Submit contest prints unmounted—no larger than 8x10 inches. With each print list camera, film, lens opening and shutter speed, illumination and developer. Write your NAME and ADDRESS on the back of each print and wrap securely with cardboard or corrugated stiffeners. ENCLOSE POSTAGE for the return of unused prints. Published prints cannot be returned. Address: Photography Editor, MECHANIX ILLUSTRATED, 1501 Broadway, New York 18, New York.

PHOTO KINKS

SOLUTION MIXER: Use motor from small non-oscillating electric fan for stirring. Lamp in series will slow motor action.—G. D. Jones.



CAMERA SUPPORT FOR TABLE TOPS: Remove handle from an old iron and replace with bent strap. Tilt-top fastens to end—H. Heydorf.

BRUSH HOLDER: Mount a camel's-hair lens brush in a fountain pen case to keep it clean. Remove point and ink bag; wrap bristles in paper to facilitate entry. Then cut off rest of handle.—B. Nielson.

STORING DEVELOPER: Keep bottle of D-72 filled to top with water as solution is used; it must be diluted for use anyway. Keep a record of the dilution.—Earl Nave.

PORTABLE LIGHTS for

A pair of these fixtures are excellent for copying.

Ordinary bed lights can be adapted for use in your darkroom. They'll hold photofloods or safelights where required.

by J. Modroch

SOURCES of light are required for almost all operations performed in a photographic workroom. Some operations, however, may not be performed often enough to warrant investing in a separate set of lighting fixtures for each of them. This is true especially of home setups where the volume of work is small in comparison with the cost of equipment.

The problem can be solved economically by employing lighting fixtures that can be used interchangeably on the various apparatuses used for photocopying, projection, tracing, printing, flood-flash photography and also to provide illumination for developing, loading and other darkroom work as well. Thus one or two sets of fixtures can be made to do the work of a half dozen or more.

A pair of common bed lights of the type having a metal rotating shade are ideally suited for this purpose. No. 1 photoflood, 60-watt and safelight bulbs will fit them. They can be used "as is" except for rebending the clamps and fitting them with thumb screws. It is advisable, however, to braze the seams of the shades if photoflood bulbs are to be used in them a considerable part of the time. Otherwise the heat from the bulbs is liable to open the seams by melting the solder used in their manufacture. Then give the interiors a coat of aluminum or other suitable light-reflecting paint and refinish the exteriors with flat black enamel.

A pair of these interchangeable fixtures can be clamped on the sides of a photocopy box like the one shown in Fig. 1. A box of this size will hold copy work measuring up to 11" by 14". The mounting board can be

Details of light are shown below.

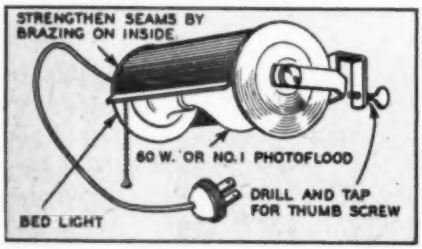
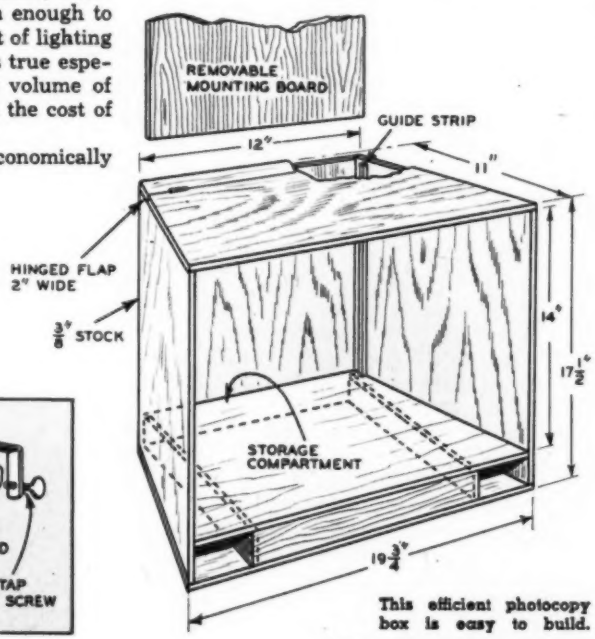


FIG. 1



This efficient photocopy box is easy to build.

removed from the box, making it convenient to tape or tack the work in position. The hinged flap, which covers the slot through which the board slides, prevents outside light from entering and interfering with the copying illumination. Paint the inside of the box flat black to minimize the amount of stray light that might be reflected back into the camera lens.

The same set of fixtures will provide illumination for a projection tracing stand of the fixed-focus type shown in Fig. 2. The work to be traced is laid on the "shuffle board" which rests on the bottom of the base and has a dowel handle that extends through a slot cut in the front. By means of the handle, the board can be moved around for the purpose of centering the projected image of the work on a sheet of tracing paper placed on the glass top. The lens is mounted in the hinged upper section between the "shuffle board" and the tracing glass.

The focal distances *A* and *B* must, of course, suit the lens being used. The best way to determine the focal distances required for any particular lens is to experiment, using cardboard boxes as trial mounts. On the tracer shown, which was built for use with a 3¼"x4¼" wide-angle camera lens having a focal length of 8.5 cm, *A* measures 5" and *B* measures 10½". The size of the image that is projected in this case is equal to two diameters of the original. If an image of four diameters is desired, then the tracing is put in and projected. And for [*Continued on page* 134]

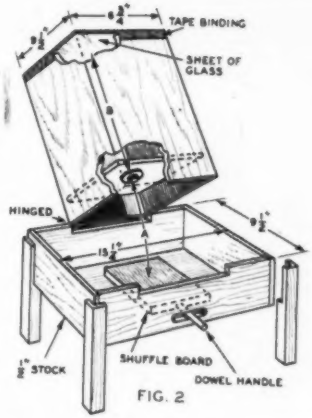
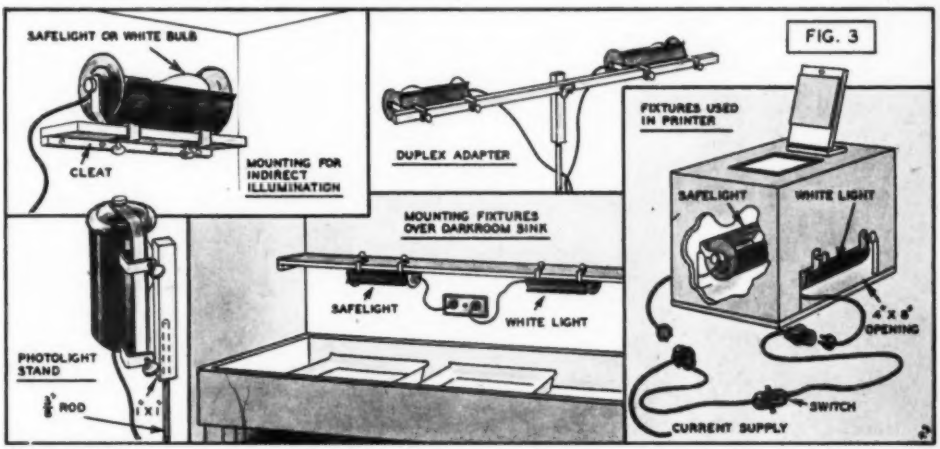


FIG. 2

At right and above is a projection box photographers will like. Additional uses of lights are shown below.

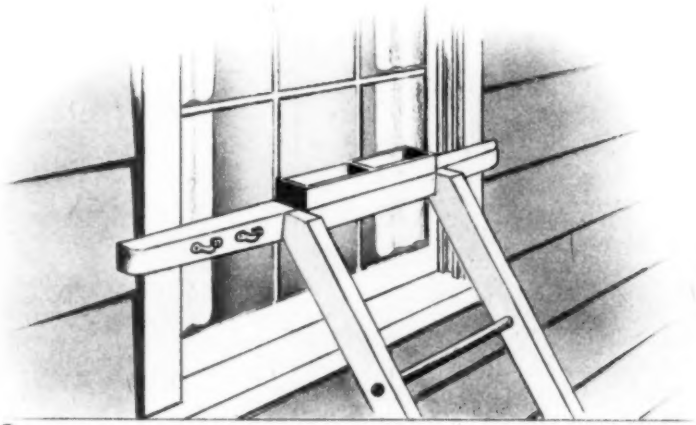


White Edge On Door Prevents Accidents

YOU won't be able to blame a door for your next black eye if you paint the edge of the door with white enamel as shown. The enamel will catch stray rays of light in dark rooms and cause the door edge to become sufficiently visible for you to see and avoid it.

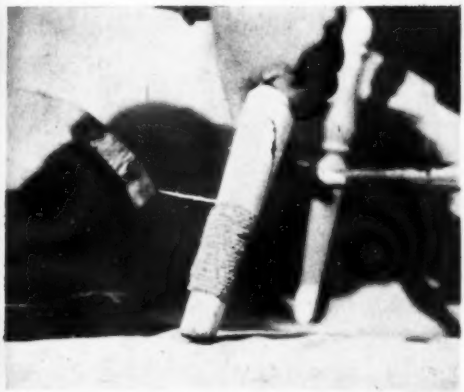
Cooking Hint

FREQUENTLY it is difficult to find the garlic clove in soup or stew so it may be removed before the food is served. To avoid this annoyance draw a thread or string through the bud before lowering it into the cooking food, letting the ends of the thread extend over the side of the pot; in this way the garlic can be lifted out.



Ladder For Window Work

FOR work at window level, such as adjusting storm sash, attach a 2-by-4 to the top of your ladder. It provides a ledge for straddling the window frame and a place for tools.



Number Stamp

A NUMBER stamp for numbers from 1 to 9,999 can be made from two date stamps. Replace the date band of one with the number band from the other, and cut the top off the V in NOV leaving NO. Remove year bands, also.

Wet-String Vise

HEAVY cord, especially hemp, expands when wet and contracts when dry. Wrap the glued splice tightly with wet cord as above and it will draw the glued parts firmly together until they are dry.

Pot Scraper

A SCRAP of wire window screen, with the edges folded toward the center, is an excellent substitute for steel wool. It can't prick your fingers and does a better scraping job.

Sprung Bobby Pins

BOBBY pins which have lost their "grip" can be readjusted by bending their ends across each other as shown. When released, the ends will snap back and fit snugly together.

KEEP IT ROLLING!

by Frederick C. Russell

TRY IT!

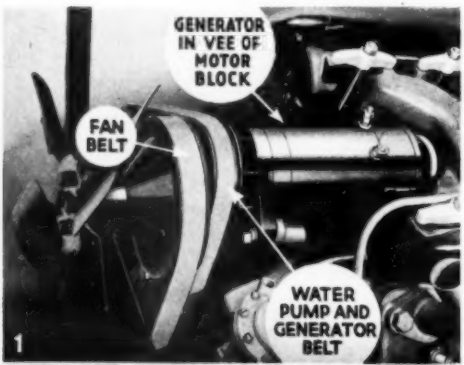
YOUR car's lights are a handy clue to the efficiency of battery, wiring and connections. A poor ground or a bad connection at the battery is indicated by having the lights go out when you step on the starter-button. An open circuit in the starter-motor or switch control is suggested by the lights staying bright without the starter-motor failing to go into action. Battery weakness is suggested by dimming of lights while the starter-motor is in action. This may also be a hint of broken strands in the starter-motor cable or the use of too heavy an oil.

CHECKING MOTOR "PING" will be your biggest motor problem this summer. It can be held in check only by cutting down performance and guarding against overheating. Many water pumps are belt driven, a point that may easily lead to trouble if overlooked. (Fig. 1.)

DUAL HORNS that blow feebly may fail altogether on an old car because of resistance in the various connections and line losses. Usually there's no advantage in readjusting the horns themselves for tone changes. Install a horn relay, or booster (Fig. 2). This provides a more direct path for the current by causing the horn button circuit to control that for the battery-horn circuit.

CARBON CLEANING may seem simple enough but there are many pitfalls. One is the risk in scratching the polished surfaces of the cylinder head. Scrape but don't scratch. Injuries to the surface leave a foundation for more rapid formation of a new carbon deposit. (Fig. 3.)

ENOUGH IS ENOUGH always is a safe rule to follow when fussing with the car. That goes for adding rust inhibitor to the cooling system. A pint of prepared inhibitor does for all summer (Fig. 4). If you use emulsifying oil bought in bulk one-fifth of a pint is enough.



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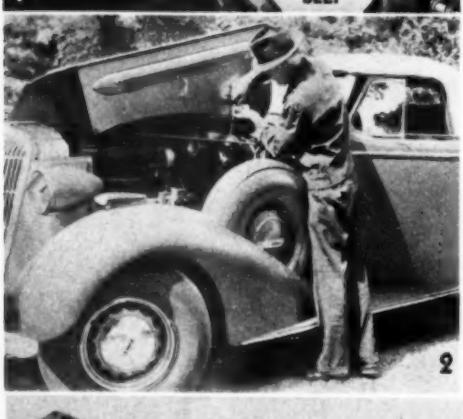
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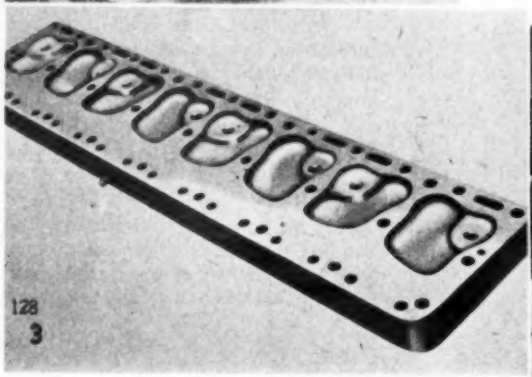

3

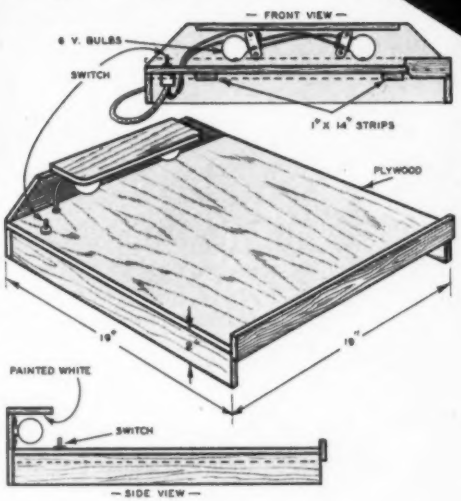
4

Your car needs careful attention, particularly during wartime. If you have a problem with your car, ask Mr. Russell. Just send stamped, self-addressed envelope to him at Mechanix Illustrated, 1501 Broadway, New York 18, N. Y., for a reply.

Convenient Auto Desk

THIS small desk, which can be slipped over the wheel of any car, will prove very handy and useful to salesmen who wish to stop by the roadside for making out business reports.

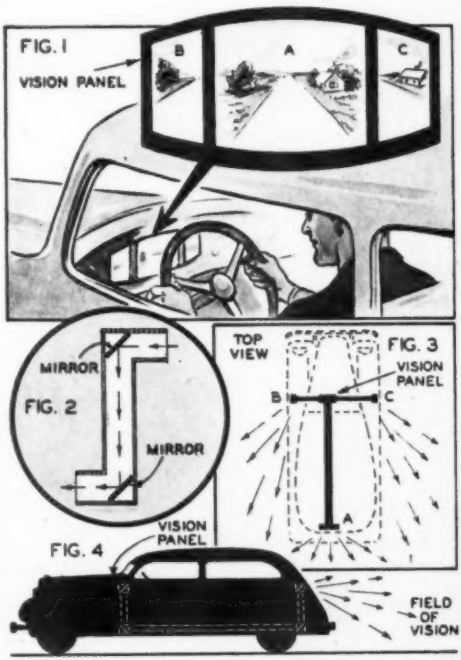
The dimensions will depend upon the wheel size of your car. Plywood about ⅝" thick is the best material for construction. Small finishing nails hold it together, and the stain or varnish used should be selected with some thought for the color scheme inside the car. The lights used are 21-c.p. headlights connected in parallel. A small switch is mounted on the upper part of the desk for the control of the lamps, and the lead can be plugged into a dashboard outlet. Paint the lower side of the lamp visor a dull white.

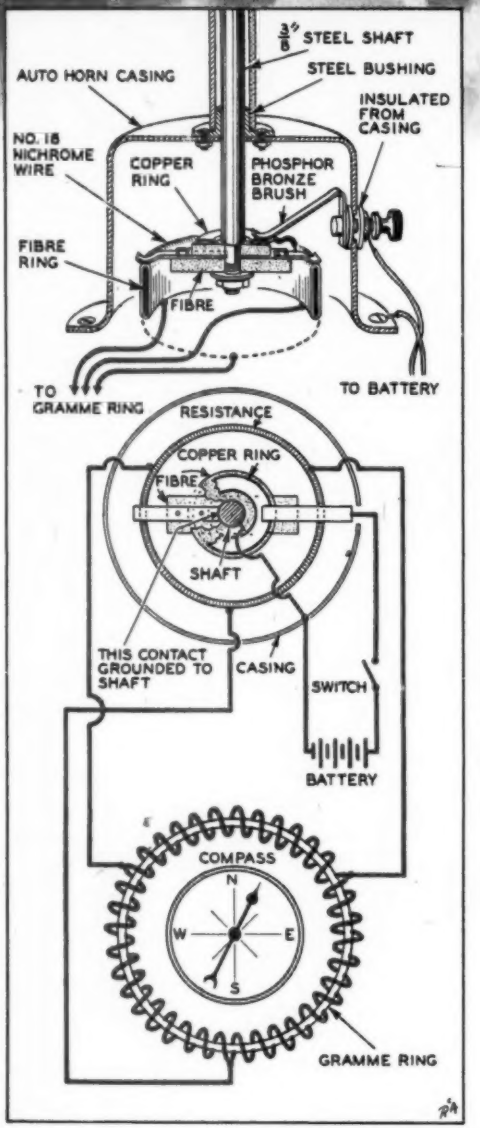


Rear View Reflectoscope

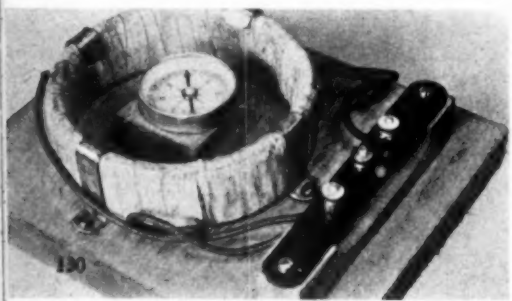
AUTO owners who are mechanically inclined can try their ingenuity on this gadget which will enable them to get an unobstructed view of the road behind.

It is constructed on the same principle as a periscope. Images are reflected through tubes by means of mirrors, and the final mirror image is transmitted to a screen on the dashboard by a lens system which furnishes an upright, real view. Ground glass can be used for a screen and lens positions can be determined by trial and error. In the diagram shown, three sets of "seeing eyes" are provided, one for each side of the car and one for the rear. The dash screen is separated accordingly into three parts, one for each view. The location of the system is suggested in the diagram at the right.





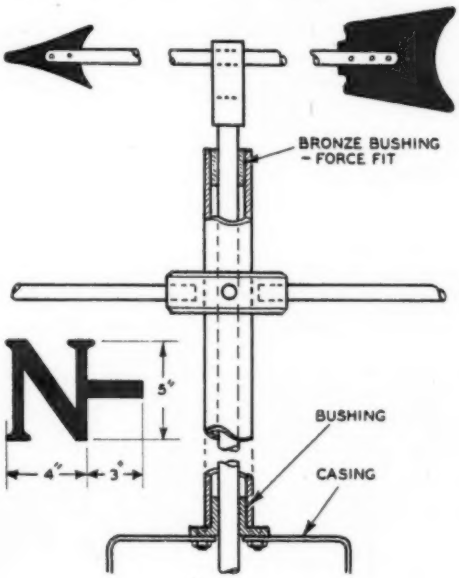
A simple compass is used to indicate wind direction.



REMOTE CONTROL WEATHER VANE

HERE'S a brand new idea for that remote control weather vane that you have always wanted and yet never quite knew how to make without installing a couple of dozen wires between the roof of the house and the inside station where the indicating device was to be situated. This weather vane requires only three small wires and the exact position of the outside vane will be indicated on a small compass needle inside the house. There are no complications, no flashing lights, no expense to speak of and it consumes no electric current except when a reading of wind direction is taken.

The electrical circuit involved is very simple as will be [*Continued on page* 154]



FROM ARCTIC BLASTS TO SWELTERING TROPIC HEAT

OUR fighting men wouldn't give a nickel for equipment that let them down when the going got tough! The Evinrudes that serve on battle fronts around the world must take things as they come . . . must keep driving steadily along regardless of fantastic extremes of climate and the rigorous demands of combat operations.

Evinrudes were ready for such service! Long before war threatened they were "in training" for rugged assignments, *anywhere*. From polar icecap to humid jungles, Evinrudes have been covering the remote waters of the world for more than 30 years!

1 Jungle Ambulance! Over jungle trails, miles are measured in endless hours of labored, painful progress. But here an Evinrude-powered small boat helps give wounded jungle fighters fast and merciful transport from front lines to the base.

2 Crew Carries Boat — and motor! So light are the Army's Storm Boats that their crews can readily carry them and their powerful motors. Underway, they "plane" like racers, can be "crash-landed" on beaches completely clear of the water.

3 On Rubber Boats, as on many other types of craft, outboards are the only practical motors! Evinrudes power many sizes of rubber hulls, from this small Navy utility boat to large rearming and landing boats with a load capacity of several tons.

4 No New Evinrudes for pleasure use until they are no longer needed by our fighting forces. Then they will be available again . . . new peacetime Evinrudes . . . the finest you have ever enjoyed! EVINRUDE MOTORS, Milwaukee, Wis.

EVERY DOLLAR YOU INVEST HELPS SPEED VICTORY . . . BUY MORE WAR BONDS

Learn About Lenses

[*Continued from page 89*]

your eye, and away from the object when holding it at a distance from your eye.

The low-priced cameras with which most people take their first snapshot contain a single element meniscus or concavo-convex lens. By inserting a diaphragm so that only the center of the lens is used, many aberrations are eliminated or reduced and good pictures can be secured with favorable lighting conditions.

While a single element positive lens will project an image, the definition is poor and unsatisfactory for most purposes. A projection lens, however, need not be as correct as a high-speed camera lens. Thus, in most cases the achromatic type is used for this purpose. The lower-priced ones consist of two single element lenses separated by an air space while the more expensive ones may contain two double or triple element lenses separated by an air space. Anastigmat lenses from old cameras or enlargers usually will make a very good projection lens. An achromatic lens from binoculars, however, generally will not give good results.

There are various kinds of telescopes that employ slightly different optical systems. The amateur will find that the Galilean type is the most practical for him to construct.

The objective lens may be a plano-convex, double-convex, or, if you can secure one, an achromatic lens. The eyepiece lens may be either a plano-concave or a double-concave lens. The power of a telescope is determined by dividing the f.l. of the eyepiece lens into the f.l. of the objective lens. A small pocket telescope with an eyepiece of 45-mm. f.l. and an objective of 92-mm. f.l. will have a power of 2X. This little telescope, while not very powerful, is an excellent one to make; it is so small that you can carry it with you easily at all times in a corner of your pocket. With a plano-convex lens of 393-mm. f.l. and an eyepiece of—34-mm. f.l. you can make a 12-power telescope.

To determine the length tubing you will need, hold the concave eyepiece lens up to your eye. With your other hand hold the convex lens in front and gradually move it out until you focus on some distant object. Note the distance by which the lenses are separated. If the above lenses are used, it will be about 9½". Take a piece of tubing slightly shorter than this, say about 8½" long, and into this slide a piece about 9" long.

Brass or plastic tubing makes a nice job, but if not available, use cardboard tubing like that which comes with paper hand towels, shelf decorating paper, etc. Paint inside and out with black paint. To make the 9" piece of tubing telescope into the other piece, merely slit it down its entire length with a razor blade and remove a section ⅛" wide. Squeeze it together, apply plastic adhesive along the slit and allow to dry. Then insert it into the 8½" piece.

Lathe For Modelmakers

[*Continued from page 93*]

lower parts of the bearings and tap them $\frac{5}{16}$"x18 T. P. 1. Next assemble the caps on the bearings drawing the studs up tight and drill the spindle holes. Start these with a ⅜" drill running a ⅝" through to finish them.

The two bearings are equipped with bushings made from ⅝" brass or bronze tubing with an inside diameter of ½". These are split as shown and held in place in the bearing and cap with a touch of solder. Don't use too much solder as you may want to remove and replace them at some future date. Next, cut the two pieces of ¾" angle iron and fit them to the lower ends of the bearings with the four studs as shown. Cut and file the two side plates to shape and assemble them in place with four $\frac{3}{16}$" screws. Drill the holes for these screws right through the two bearings and tap them from each side. The headstock is now complete except for filing out the holes for mounting on the bed slightly oval with a round file. This is to allow for a slight side adjustment when lining up the spindle.

The saddle and dovetail ways for the cross feed should be made up next. These parts are clearly shown in FIG. 6, and are assembled as shown by the dotted lines. Cut out the ⅛" plate D. first and file up the edges square. Drill the three 5/32" holes for the screws marked D. 1, 2 and 3. Make the two parts E. I. and F. I. assembling them in position on the underside of the plate D and clamping them firmly in place, drill the holes in E. 1 and F. 1 using the top plate as a guide. Remove the clamps and tap F. 1 to take the three screws, redrill the plate D and the part E. 1 to clear $\frac{3}{16}$" and screw the parts together with a strip of shim brass between E. 1 and F. 1 to allow for clearance on the bed ways. Make the gib G. from a piece of ⅛" steel, drilling it with the point of the drill only, to take the two adjusting screws which are threaded and countersunk into the part E. 1 for this purpose. Details of this arrangement are shown in FIG. 6. You can now fit the saddle over the bed with the gib in place and assemble the parts E. 2 and F. 2 to the plate D. using the clamps as before and drilling the three parts at once using the 5/32" drill first.

The dovetails are easily made from ½"x½" steel as shown. Mark off a width of $\frac{5}{16}$" with your scriber and with the piece held firmly upright in a vise, saw down the outside of this line on an angle with the corner of the stock. When this has been done file them carefully crosswise to remove all saw marks, then file them smooth lengthwise. Finish them up by smearing them with oil and polishing with emery cloth.

In mounting the dovetails on the plate D. mark off the center lines for the six screws with the saddle on the bed and a steel square held along one side of the bed to insure the ways being at right angles. Screw one of the dovetails in place

[*Continued on page 134*]

INDIAN
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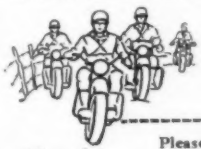
Hidden Lakes

SOMEWHERE . . . cradled 'way up in the mountains where few people ever get to go . . . there's a clear, blue lake inviting you. The road up to it is too tough for a car, but to a motorcyclist, it's a snap. That's the beauty of owning an Indian . . . it'll take you to places you can't otherwise reach . . . takes you to good times and great sport . . . brings you the friendship of red-blooded fellows everywhere. And best of all . . . an Indian handles so easily . . . responds so readily, and rides so smoothly even over rough roads that you'll feel confident and safe. Be among the first to own and ride a new Indian when this war is over.



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Lathe For Modelmakers

[*Continued from page* 132]

first, then drill and tap one hole in the end of other and screw it to the plate; when this has been done, measure across the ends with a pair of outside calipers and adjust the one side until both ways are exactly parallel. When you are satisfied that everything is all square, the other two holes can be drilled, the screws inserted and drawn up tight. The end plate C. is next made and screwed to the ends of the dovetails as shown, the center hole being drilled 5/16" to take the cross feed screw which is shown in FIG. 7. This part is made up to the dimensions shown from a standard 5/16" x 6" machine bolt and a 3" length of ½" rod. The bolt thread is continued for a distance of 4⅞" with a 5/16" x 18 die. The head is then cut off and the end inserted in a 5/16" hole drilled into the end of the ½" rod where it is held in place by a $\frac{1}{16}$" pin countersunk and riveted. This is clearly shown in the detail sketch of the handle assembly FIG. 7. The collar B. is also made from a ⅜" length of ½" rod filed down slightly to clear the upper and lower plates of the slide. This is screwed on after the feed screw has been inserted in the end plate C. FIG. 6. Adjust this collar so that the feed screw turns freely but without end play. Both feed screws and handles are built up in the same manner as shown at E. the cranks and balls being dispensed with until they can be turned up on the lathe itself.

The longitudinal feed screw FIG. 5 and the two brackets C.C. can next be taken in hand. The two brackets, also shown in FIG. 8. are made from 1¼" x 1¾" angle iron to the dimensions given on the drawing and are attached to the bed by two 5/16" studs. The left and right brackets being placed 5½" and 1¾" respectively from each end of the bed as measured from the outside corner of the angles. In attaching the right hand bracket drill the hole so that the head of the stud won't interfere with the collar on the feed screw.

The making of the feed screw itself, should be quite clear from the drawings. The left hand end is drilled and tapped to take a short length of ¼" rod which is screwed in tightly and then cut off leaving ⅜" projecting to turn in the left hand bracket. It is then threaded ½" x 13 for a distance of 13". Note also that the set screw is not threaded into the collar, but into the feed screw shaft.

The feed screw nut is made from a piece of ⅞" square stock to the dimensions shown at H. FIG. 6, and is held in place under the parts F. 2 and E. 2 by two screws threaded into these parts. The two screw holes being filed out with a ⅛" square file so that the nut can be adjusted to travel the full length of the feed screw without binding.

The compound rest can be made and assembled next as shown in FIG. 9. The dovetails for this and the cross feed slide FIG. 10, are made in the

[*Continued on page* 136]

Back-Lighting For Copying

[*Continued from page* 121]

light from curling it. The light itself is an ordinary, low stand and an electric bulb (wattage depending upon the weight of the print paper) with a curved reflector of cardboard or photo-blotter placed behind it. Set up your camera and adjust the back light to bring out all possible shadow detail. A front light, located on one side to prevent reflections, is used to illuminate the front of the print.

Exposure is determined by means of a meter and test shots. The texture of the paper will show, of course, but seldom proves objectionable. Photo 1 is a straight copy, while photo 2 was made as described.

Portable Lights For Darkroom

[*Continued from page* 125]

further enlargement, the procedure simply is repeated. In this manner, details can be enlarged to any degree desired.

A printer can be adapted for use with the same fixtures by cutting an opening in each side to receive the shades as shown in Fig. 3. If desired, a cord switch controlling the printing circuit may be connected in series with a plug and cord tap into which the fixture containing the white printing lamp can be plugged. Only a straight tap connection, of course, is needed for the safelight lamp which supplies light for masking but may be left burning continuously while the printer is in use.

Cleats, fastened on the darkroom wall, may be used as mounts on which the fixtures can be clamped when used as developing and loading lights. Indirect illumination can be produced by rotating the shades to throw the light rays against the wall and ceiling as illustrated.

The simple adapters shown permit the fixtures to be mounted on photolight stands for the purpose of making interior photographs, using either flood or flash bulbs. Due to the extreme compactness of the shades, these fixtures can be used to advantage when photographing in doorways, narrow halls and other close quarters where limited space prohibits the use of conventional reflectors.

To insure that a range finder for a fighting ship can "take it," the instrument is tested with terrific shocks and vibrations.

To start a blood bank in Richmond, graduates of the Medical College of Virginia have given a pint of blood apiece—value in money, $1,850.

The United States can make soap out of any kind of grease, but without some tropical vegetable oils and imported essential oils we would have the coarse, unlathering soaps of earlier times.

Finer-than-ever Cameras . . . Better-than-ever Photographs!

Many a sea dog's postwar album will be filled with once-in-a-lifetime shots like the top one. But the most priceless subjects of all wait to be taken back home when the war's over. Then *everybody* will be taking *better* pictures than ever before! For new skills and revolutionary methods of large scale precision production have been born out of Universal's ceaseless 24-hour-a-day devotion to the war effort.

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Peacetime Manufacturers of Mercury, Cinemaster, Corsair Cameras and Photographic Equipment

Lathe For Modelmakers

[*Continued from page* 134]

same manner as previously described for the saddle. The ¼" piece L. is attached to the circular plate P. with the two short screws shown in the drawing and the two dovetails K.K. are held in place by the six long screws. The circular plate P. is mounted on the cross feed slide A. FIG. 10, by means of a short round-headed stud. The edge of the plate can be beveled and marked off in degrees for taper turning if desired. In drilling the compound rest nut J. screw this to the plate G. FIG. 9, in the position shown by the dotted lines, after the two dovetails H.H. are in position then, with the gib in place, slide the rest onto the two lower ways, and mark the hole for the feed screw from the hole in the end plate M. The nut can now be removed, the hole drilled and tapped and the nut screwed back in place. This procedure insures the feed screw being in alignment with the dovetails and should be followed for the cross feed nut also.

The tool post B. is made from a ½" steel bolt. Form the slot by drilling a series of ¼" holes and filing out the metal between. The wedge D. is filed from a piece of ¼" stock, and the ring C. is turned on the lathe from a piece of 2" steel bar, a temporary ring being rigged up from two heavy washers until this can be accomplished.

The tailstock should present no difficulties of construction, full dimensions being given at FIG. 11. The two bolts E.E. pass through the lower part C. the two uprights B.B. and are threaded into the horizontal part A. The two parts L. and K. which hold the tailstock handle in place fit into the groove on the handle shown at B. FIG. 12, and are attached to the back end of the tailstock with the four screws M.

The spindle locking device is clearly shown at G. and consists of two pieces of ½" square stock held in place by three screws to allow for a clamping action when the handle H. is tightened down. This handle is made by threading a collar onto a 5/16" bolt and bending as shown after the head has been cut off, the lower part of the lock being tapped to receive the threaded portion.

The part C. extends ⅛" below the two angle irons to form a guide for the tailstock in the bed slot. The clamp P. is made up as shown and is held in place by a 7/16" x 3" steel bolt the nut of which is filed to fit against the ⅛" plate which is screwed to the back of the two uprights B.B.

The spindle arrangement is shown in FIG. 12. The slot D. being made by drilling a series of ⅛" holes and removing the surplus metal with a narrow chisel. The stud J. FIG. 11, engaging this slot is screwed into the tailstock in line with the spindle and ½" from the forward end. When you have the tailstock completed except for drilling the spindle hole, the headstock can be mounted on the bed by means of four 5/16" studs and the spindle lined up. This is done by inserting a 24" length of ½" drill rod in the bearings and testing with a steel square until you get it parallel with the bed. This procedure is shown in FIG. 15.

When you have the headstock lined up to your satisfaction, the spindle can be made up from the drill rod used for testing as shown in FIG. 13. This is threaded to take a ½" drill chuck after which a large steel nut is screwed on and turned down to form the collar B.

The tailstock spindle is threaded the same as the headstock spindle to take the ½" drill chuck and both spindles are drilled in the lathe to take the centers shown at C. FIG. 13. This screwed center was used instead of the more conventional tapered center simply because a suitable reamer for reaming the tapered holes in the spindles wasn't on hand at the time of making. However, I found that they worked perfectly, so have never bothered to change them. The shanks are turned up in two ½" x 1¾" lengths of drill rod and threaded. They are then screwed into the headstock spindle and pointed by setting the compound rest to 60 degrees after which they are hardened by heating and quenching in cold water.

The making of the faceplate shown in FIG. 14, completes the construction of the lathe. This is made up by threading a 1¾" length of 1½" steel shaft onto the spindle nose and turning down to form the hub. This is then riveted, with countersunk rivets, to a ¼" x 4½" diameter steel plate drilled and slotted as shown.

Draining Wet Gardens

[*Continued from page* 95]

springs from surfacing in the bed. On sloping land, this sometimes can be accomplished by trenching the plot just below the bed as shown in Fig. 2, which encourages the spring water to strike new horizontal underground veins in the direction of the ditches. Trenching for this purpose should run quite deep, from 1' to 3', and should connect with a sump that is large enough to drain off the water as quickly as it accumulates.

Level gardens troubled by sogginess resulting from outcropping spring water can be drained by replacing the subsoil beneath the wet spots with a fill of loose stone or gravel as shown in Fig. 3. The depth of the fill should be at least 3' to be effective in average cases. Before digging out the subsoil, remove the topsoil. Then replace it after filling the excavation with stone.

In the stone-walled garden shown undergoing construction in the photograph, effective use is made of common drainage tile pipe to facilitate the draining action of the gravel-filled paths which border and drain the beds. With the piping embedded in the paths, the depth of the gravel need run only 1' in depth as against 3' or more without it to attain adequate results.

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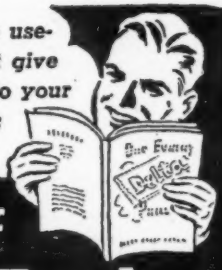

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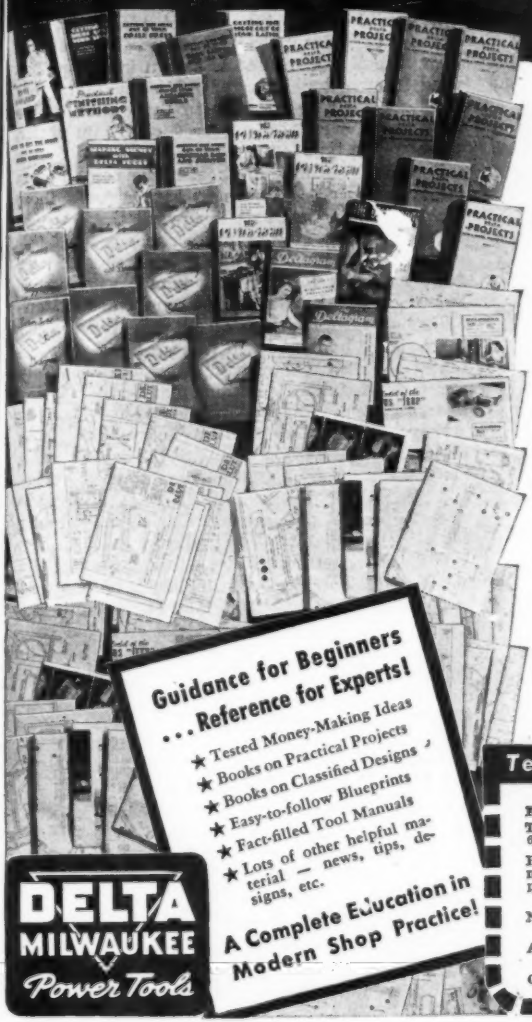

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The School Shop

[*Continued from page* 105]

consist of stratiform clouds and rain. In our weather scheme, there is a close relationship between fronts and low pressure or cyclone areas. Just as a wind blowing over a large body of water causes waves and white caps, a cold air mass moving past a warm air mass will form a horizontal wave of warm air which projects into the cold air as shown in the drawing. The rear of the wave is a continuation of the cold front with cold air digging under, while the forward portion of the wave is a warm front with the warm air overrunning. At the crest of the wave the warm air is forced upwards and a low pressure area forms. The cold front moves faster than the warm front and finally overtakes it, forming an occlusion.

One of the most interesting of nature's weather displays is the thunderstorm. Awe-inspiring and threatening when seen from the ground, it offers no great menace to the pilot if he is careful not to get too close.

The principal characteristic of a thunderstorm is a violent upward current of air; velocities in excess of 200 m.p.h. have been recorded in severe cases. Downward moving current also exists, and their reaction with the vertical currents is to form a severe whirl in the heart of the storm cloud.

The principal types of thunderstorms are the *thermal* and *mechanical*. The first is formed by uneven heating of the earth's surface which causes rising convection currents (our old story of cumulus cloud formation). The second is caused by a mechanical action, such as the wedge of cold air throwing upward the warm air and forming a line squall as the case of a fast moving cold front. An *orographical* thunderstorm (a mechanical type) occurs when warm, moist air blows up the slope of a mountain, causing excessive condensation and storm conditions near the top.

When a pilot meets a thunderstorm, he has a choice of four procedures; he can fly around it, fly below it (if he can maintain sufficient clearance below the storm and above the ground), fly over it, or land until the storm is past.

The Civil Aeronautics Authority suggest that you follow these two general rules for safety:

I. Don't fly into a thunderstorm!

II. Stay at least 2,500 feet away from a cumulonimbus cloud from which rain is falling!

(The School Shop aviation lessons are being published in book form titled HERE'S HOW TO FLY. The publisher is Duell, Sloan and Pearce of New York City.

There are 21 chapters and over 200 illustrations covering history, aerodynamics, navigation, meteorology, engines, load factors and parachutes, and a special chapter of 200 multiple-choice questions and answers like those used on C.A.A. Private Pilot Examinations. The price is $2.00. Copies may be obtained by writing to the Aviation Editor of Mechanix Illustrated.)

Wooden Cleats For Sailboat

[*Continued from page* 116]

line is not crisscrossed back and forth in the usual manner but simply wound around under the projecting edges.

Figure 4 shows a version of the regular metal cleat but this time made of wood. Note that it is wider than the metal cleat to gain necessary strength. This cleat is of the non-jam variety and its main use would be for making halliards fast. All surfaces must be rounded in all cleats to prevent damaging the rope and, of course, it should be securely fastened to the deck. Any of these cleats may be made larger if desired, but for a small line the sizes shown will be quite satisfactory.

Figure 5 shows the general placement and uses for different types of cleats on the small sail boat. The full-jam cleat as shown in Figure 3 is used for the double ended main sheet. Another similar cleat may be used in the center of the after deck for general purposes, or, if you prefer, the non-jam type may go here.

For handling the jib sheets, two combination cleats are used as shown in Figure 1. In these cleats the non-jam part is toward the stern so that your crew may pass the sheet around this part and hold the other end in his hand. If there is no necessity for changing trim constantly, as in a race, the sheet may be brought around another half turn, in which case it jams itself under the forward horn and will require no further attention. Be sure, however, that it is securely jammed in for there is nothing more embarrassing than to have the jib let go during a race.

Non-jam cleats are used on deck just abaft the mast, one for the jib halliard and the other for the main halliard. The halliards come down the mast and pass through cheek blocks on either side close to the deck. A combination cleat is shown for the tack down-haul, as in Figure 2.

You can make a miniature edition of either the jam or combination cleat and place it on one side of the boom as shown. Here it comes in handy for taking up or slacking off on the clew outhaul. Note the little kink that puts it up fairly close to the mast where your crew can always get at it even when the boom is off. Many small boats have this cleat 'way out at the end of the boom where it cannot be reached except when close-hauled—the very time when you don't want to touch it.

An oak tree with about 700,000 leaves is estimated to give off 244,695 pounds of water from June to October.

Special flashlights for night traffic control of U. S. Army convoys have a red light for normal night conditions and a blue light for blackouts.

A dental surgeon explains that the final forward and downward growth of the face occurs between 16 and 19 years of age.

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Life Begins At 140

[*Continued from page* 41]

Hammer-and-Sickle Gold Medal on his chest, made him Hero of Socialist Labor, the highest distinction it can grant. The Army paper, Red Star, cited thousands of cases of amazing recovery.

Bogomoletz became a disciple of E. Metchnikoff, famous Russian biologist immortalized in Paul de Kruif's *Microbe Hunters*. Metchnikoff was a boisterous, exotic man. His brilliant mind was always brimming with new ideas. They seemed fanciful at first sight, but there was invariably a grain of truth in them. Most of the time, though, he was too impatient to follow through with painstaking laboratory experiments.

Longevity was one of Metchnikoff's pet-horses, at least for a while. Amongst other things he claimed that whenever any part of the human organism ages, there appears around these parts an increased activity within the adjoining cells of the connective tissue. In this he saw one of the causes of old age. The human organs had to pay a price to the connective tissue for holding together the various parts of the body. With a snap of the finger, Metchnikoff labeled the connective tissue an "ignoble tissue."

Bogomoletz never had any of the flashiness of his master. He measured thrice before cutting once. After careful studies, he decided that the impetuous Metchnikoff had once more overshot his mark.

If the cells of the connective tissue get so busy when man ages, what are they doing when man is still young and healthy? Maybe they have some part not only in his getting old, but also in his staying young? What other proof than his own say-so did Metchnikoff offer for the increased activity of the connective tissue cells as the *cause* of old age? What if it were the *consequence* of old age?

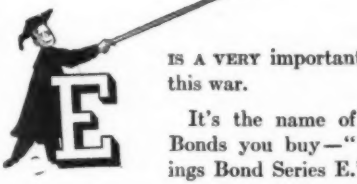
Metchnikoff was right and wrong at the same time. There are a lot of physiological changes going on within the connective tissue cells. But they do not occur only when man grows old. And they don't impair the life of the surrounding organs. Quite the contrary. Without the high-pitched, everyday labor of the connective tissue cells, human life would be doomed.

With this discovery, Bogomoletz added a new chapter to the story of human physiology, a story as exciting as a Hollywood action thriller. As he saw it, the connective tissue cells are in reality the most tireless working bees in the biochemical factory called the human body.

Take the reproduction of blood corpuscles. Unless you want to die a certain death, your body must renew its entire supply of red blood corpuscles every sixty days. That means your organism must daily raise an army of 350 to 400 million new red blood corpuscles. Where do they come from? And where do the millions of used-up blood corpuscles go? They can't come out of or

[*Continued on page* 142]

Some ABC stuff about E



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That's why you should hang on to every Bond you buy. You can, of course, cash in your Bonds any time after you've held them for 60 days. You get all your money back, and, after one year, all your money plus interest.

But when you cash in a Bond, you end its life before its full job is done. You don't give it its chance to help you and the country in the years that lie ahead. You kill off its $4-for-every-$3 earning power.

All of which it's good to remember when you

might be tempted to cash in some of your War Bonds. They are yours, to do what you want with.

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Life Begins At 140

[*Continued from page* 140]

vanish into thin air within or without the body.

This is where Bogomoletz's new findings come in. When your blood travels along the inner lining of the arteries and veins or through the capillaries which connect the arteries and veins, it is running along a vast system of connective tissue. The cells of this tissue set to work on the blood like a churning chemical plant. They snatch away vital substances and send them up to other organs. They bring new, living matter to the blood. They collect and work off the waste. This goes on throughout the body.

So, when Metchnikoff found increased cellular activity in the connective tissue during old age, it was not because those fiendish cells were sapping man's last strength. That was a very unfriendly view to take. Actually, those brave fighters were doing their best to rebuild the old body's vitality. That's why they multiplied and spread and labored away. But man aged because the connective tissue aged and could no longer work efficiently.

Old Metchnikoff had dreamed about a serum that would *fight* the "ignoble" connective tissue cells, and thus save humanity from getting gray and shaky too soon. But he never did anything about it.

Not so Bogomoletz. He dreamed about a serum that would *stimulate* the working bees in the connective tissue. And he did a lot about it, in his quiet and patient way.

Bogomoletz doesn't look upon his serum as a cure-all. He states expressly that every illness must be treated with all the current therapeutical or surgical means. But in many of these cases his ACS, by stimulating the connective tissues, will hasten recovery, especially when the main struggle in the organism occurs in the first line of body defense.

As far back as 1938, it was a foregone conclusion to Bogomoletz that his serum could speed up the healing of wounds and bone fractures. "The healing of wounds," he wrote then, "consists in the growth of connective tissue. Its cells grow toward each other, surrounding the wound's edges with firm fiber, which gradually consolidates and forms a solid scar."

He also anticipated that his serum could be used in a variety of ailments with a fair average of success, since he had established the farflung influence of connective tissue.

For several years he experimented with *cancer* transplants. They were first bombarded with large doses of ACS. Their growth was blocked. But when small doses were used, a tightening ring of phagocytes appeared around the cancer plasma, forming an increasingly sharp line of demarcation between diseased and healthy tissue. With the aid of his serum, one of his collaborators succeeded in completely eliminating large cancer tumors on mice. In the cure of human beings, ACS

Life Begins At 140

already has helped in forestalling recurrence of stomach and breast cancer after surgical removal.

Next, the serum has come to succor many sufferers from *hypertension* (high blood pressure). High blood pressure, caused by arterio-sclerosis (the accumulation of lime and other mineral salts in the blood vessels), is one of the most frequent symptoms of old age. Medicine has so far been unable to cope with it. But many young and otherwise healthy young people suffer inexplicably from high blood pressure. Right now, army doctors are rejecting or discharging thousands of perfect specimens, only because the blood is pumping through their veins at too fast a rate.

According to Bogomoletz, long before the real arterio-sclerosis sets in, somewhere along the course of blood circulation (in the capillaries or in the kidneys, for instance) the connective tissue's absorptive capacity falters. If ACS is applied before real sclerotic changes occur, the blood circulation can be brought back to normal. Confirmation of this view by American doctors would bring thousands of young men back to the Army.

Many persons afflicted with *psychic disturbances*, which tend to grow in a war-torn world, will also benefit from ACS. As far back as 1940, the Institute published a report on successful treatment of 250 cases of schizophrenia—a most malignant and hopeless mental disturbance in which patients lose all interest in social functioning. Research showed that schizophrenia is not simply a disease of the brain centers, but is caused by or leads to deep changes in the patients' physiological condition. ACS was used, alone or together with customary treatment. Results were most encouraging, especially in the milder cases which are the most frequent.

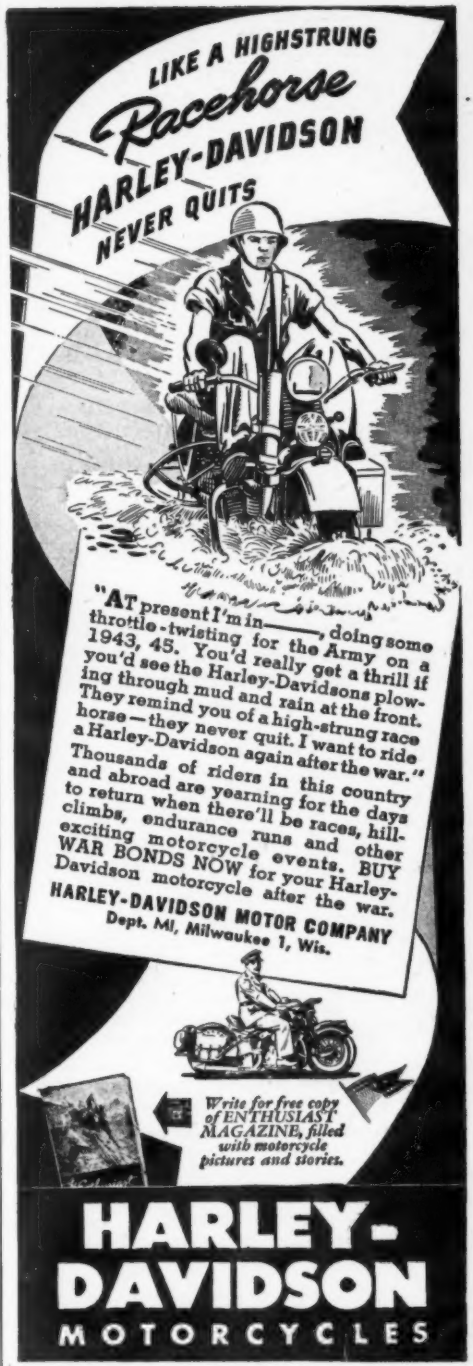
The war has given Bogomoletz the largest experimental laboratory any scientist ever had. And the spread of his findings abroad, especially to this country, will no doubt further his work by leaps and bounds.

As for himself, on the fateful day when he first announced the successful completion of his serum, he was exactly 60 years old. But with a disarming and boyish smile he assured reporters that "a man of 60 or 70 is still young. He has lived only half of his natural life."

Russia's Ponce de Leon is confidently striving toward the long-sought Fountain of Youth. He is looking ahead to a fruitful future—perhaps as the first beneficiary of his own discovery.

The sun's rays shower as much energy on the earth's surface in one minute as the entire human race utilizes in a year.

Radiators are 10% more efficient when covered with oil paint instead of metallic paint, is the verdict from research at the University of Illinois.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We've Got 'Em Covered

[*Continued from page 44*]

a gauge by which to compute and present the actual conditions.

When I arrived on an Eighth Air Force Thunderbolt base the first thing I noticed was that the famous P-47 fighters were all fitted with good-sized belly tanks. I made a personal investigation and learned that these tanks were light, cheap affairs made of fibre, wood and metal and could be dropped once the fuel had been consumed. Further investigation disclosed that our Lightning P-38 fighters, on another base a few miles away, carried two such tanks—one under each tail boom.

Unfortunately, the enemy Focke-Wulfs and Messerschmitts usually bolix up our figures and forecasts. The ideal fighter-bomber arrangement can only be experienced when we have produced fighters that can fly at the speed of the bombers and in that way conserve fuel; and at the same time be able to produce normal fighter speed and gun-power and have the range to stay in the air as long as the bombers.

The efficient planning of a bomber mission requires more than just deciding what type of bomb to drop and where to drop it. Hours are spent consulting weather charts, selecting the best route to evade enemy flak, fighter defense and weather conditions. The meteorologist must be able to advise both the bombers and fighters at just what altitude they can fly to avoid leaving those beautiful but treacherous vapor trails. The route too is selected to prevent the enemy from figuring ahead just what target the bombers are heading for.

The route in and out must fit into the general fighter range plan and all contacts must be made and completed under split-second timing. Had we fighters that could take off and stay with the bombers all the way round, much of this planning could be eliminated. As it is, a plan must be evolved and it has to be adhered to all the way around, if the bombers are to meet the fighters at the pre-arranged points.

Another glance at our typical detail-map will show how these contacts are arranged. For simplicity, we'll presume the outgoing route is split up into legs so that our No. 300 Fighter Group will have picked up the bombers at the British coastline to escort them to point "A" where Fighter Group No. 301 (all these group numbers are fictitious for obvious reasons) will take them over and escort them across the German coastline to a point near Wilhelmshafen. To the reader this will appear to be a long way round to Stettin, but this is all part of the Eighth Air Force strategy. While the bombers are heading out across the North Sea on their first leg, the German defenses have no idea what the target is to be. From point "A" the bombers can shift their course slightly and head for Kiel and the famed Nazi submarine bases and shipyards. They can swing suddenly

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north and strike for Oslo in Norway. Another feint might take them southward toward Essen, Dusseldorf or Cologne.

Instead, however, they take up a southeasterly course which threatens Hamburg, Magdeburg or even Dresden, and then suddenly they swing almost northeast and head for Stettin near the mouth of the Oder River. In the meantime the German fighter force has been split up and sent helter-skelter to all the points threatened.

That's how the bombers reach their target. But now we have the fighters to consider. Once the bomber formation gets away from the British base the first fighter-escort group, timing the contact to the second, escorts them to point "A." In half a dozen briefing rooms throughout the Eighth Air Force area, hundreds of airmen will have studied a gigantic map or plotting board on which this complete operation has been outlined.

The course of the bombers is usually marked across the map in bright red worsted. At point "A" will be found the contact time figures showing exactly when No. 300 group will turn their charges over to the fighters of No. 301 group. At the point "B" just north of Magdeburg, No. 301 will turn them over to No. 302 at the time originally designated on the plotting board. From there the bombers will be escorted to the target and started back on the homeward course. At point "C" No. 302 will turn them over to No. 303 and if possible stay with them for the rest of the distance home. Under this general arrangement, Nos. 303 and 304 can join forces and thus provide double cover all the way in, but since the actual escort is expected to zig-zag and keep back with the bombers, this may not always be possible.

On paper then, this explains the general idea of an escorted bomb mission. The writer does not offer it as an exact duplicate of any escorted mission. The detail-map is offered to show how the fighter escort times its contact with the bombers at various points.

Now let's look at the fighters' side of this problem.

In the case of No. 300 group, their job is comparatively simple. They time their actual take-off with that of the bombers, allowing for the time taken by the bombers to assemble and pick up their combat box formations. From the bomber base to point "A" they fly a distance of approximately 250 miles and if no enemy fighters harass them, the outgoing fighters—even though they do considerable zig-zagging—will not have had to fly much more than 600 miles. As stated before, most of these figures are approximate and are offered to simplify the details of this article.

The second group of fighters, however, must time their pick-up to the minute and fly out at their most economical rate of speed. Above all, they must avoid unnecessary aerial combat with any enemy fighters. As Maj. General William E.

[*Continued on page 146*]

WILD TURKEY

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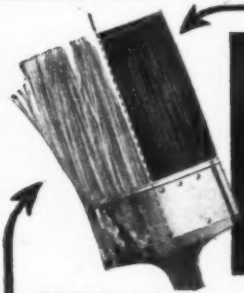

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DIC-A-DOO
PAINT BRUSH BATH

We've Got 'Em Covered

[*Continued from page* 145]

Kepner, chief of the Fighter Command, explained to me at the Eighth Air Force headquarters, the most important job of the American fighters is to get the bombers safely to their targets—and back home again.

From point "A" to point "B" the Thunderbolts may or may not have considerable trouble dealing with enemy fighters, but because of the slim leeway of range they enjoy they cannot afford to engage enemy fighters unless the bombers are actually attacked. The fighters must be content to sit above their bomb-laden charges, zig-zagging back and forth like winged watchdogs, sweating it out with their fuel gauges until they are able to turn the bombers over to the longer range escort fighters at point "B." Then they are free to turn home and—hope they can make it.

Generally speaking, the third leg which takes the bombers over their target is usually the most important. This part of the work, prior to the arrival of the North American P-51 Mustangs, was usually done by Lightning P-38 fighters, since they were able to carry two extra belly tanks and thus had the longest range of any fighter in the Eighth Air Force area at that time.

When the Lightnings were first assigned this duty escorting bombers out of Britain into enemy territory, they appeared to have considerable difficulty working at the required altitude. In North Africa the P-38's had enjoyed considerable success against Nazi and Italian fighters, but there most aerial activity was carried out at an altitude more suitable to the flying qualities of the P-38. Above Germany and the occupied countries, however, the big league of this aerial combat business, the Lightning was found to be comparatively slow in maneuverability, especially when she was burdened with exterior belly tanks.

We have now been told that certain improvements have been made on the Lightning. First of all, certain modifications to the engines have been adopted which allow the P-38 to fight and maneuver satisfactorily in high altitude thin air while flying at high speeds. In addition, new aileron boosters have been fitted to work in conjunction with the old combat flap, which, according to general information distributed, has turned the Lightning "into a dog-fighter which can outmaneuver many single-engined ships."

From material published in newspapers at home in the United States we are told that this "new" P-38 has 30 per cent more power, 30 per cent more fighting range and improved climbing ability. Nothing is said, however, about exterior tanks, and from the illustrations accompanying these articles, no such equipment is noted. To date over here, we have seen no long-range Lightning fighters that do not carry belly tanks.

No fighter pilot operating in this theater likes to carry exterior tanks. They, of course, use up

[*Continued on page* 148]

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We've Got 'Em Covered

[*Continued from page* 146]

this additional fuel first and jettison the exterior tank as soon as possible, because it interferes considerably with their fighting maneuverability, a feature the Germans must be well acquainted with by this time. When we first visited fighter stations over here we were forbidden to mention these belly tanks, but from all indications—in the Stars and Stripes at least—this ban has been lifted.

It can be seen then, that only by careful timing, tenacity in sticking to the bomber formation when enemy fighters are enticing the escort to break up and engage in dog-fights, and the most careful consumption of available fuel can a properly escorted mission be carried out. If, however, one group of fighters misses its schedule contact with the bombers a long and ominous casualty list may result.

Editor's Workbench Chips

[*Continued from page* 16]

"Jump in, Old Boy," the skipper hailed the American.

The pilot, taking another pull at his bottle of brandy, managed to focus his eyes on the English craft. He studied it solemnly for a moment, then with a resounding hiccup, replied,

"You can go to hell. You got a boat. I got a boat of my own. You shail your boat. I'll shall mine. Go 'way and leave me alone."

"Come now," the skipper remonstrated. "I see you're a bit stiff. But be sensible. Get aboard and we'll get you to England and your base."

"Go 'way," the American yelled, waving his arms. "I'm an 'merican citzen. I know my rights. Wind is in right direcshun and I bet I'll beat you to shore. Now leave me alone."

Settling back in his raft, the pilot took another pull at his bottle and grinned triumphantly.

At that moment, the crew members, using a boat hook, punctured the rubber life raft. It deflated, dumping the American into the waves. He was unceremoniously hauled aboard, spluttering and shouting in outrage about his boat and his rights.

"Now," the English skipper said rather sternly, "stop the horseplay, Old Boy, and get below to dry off and jump into some warm clothes."

"I won't talk to you," the American yelled. "You shank my boat. You can go to hell."

"See here," the skipper said, "I'll be the boss aboard this craft. You do as you're told or you'll be guilty of mutiny. Now get below."

The American eyed the Britisher balefully.

"You don't own the whole ocean, do you? Well, I know my rights and I repeat you can go to hell."

With that, the pilot dived smartly overboard.

It took a crack on the noggin with a belaying pin to drag the flier on board again and rescue him.

Cycles Predict The Future

[*Continued from page* 53]

one of the most distinct waves in solar radiation which is exactly 40.8 months in length!

Knowing that a 41-month wave in business exists, cycle knowledge can be profitable in dollars and cents entirely apart from playing the market. A dramatic example is furnished by the Westinghouse Company which, back in 1935-36, used this cycle to help them foresee that 1937 would see a marked downward trend in their business. The company therefore refrained from overexpansion and waited until 1938 to invest $10,000,000 in capital equipment, anticipating rising business in 1939 and 1940. Events amply proved the wisdom of this decision. Many other examples could be given.

Let us now turn to the findings of another well-known student of business cycles, Edgar Lawrence Smith, and see whether he agrees or disagrees with predictions already given for the years ahead. Mr. Smith is particularly concerned with the stock market, and he discerns a marked tendency of fluctuations to repeat themselves every ten years in what he calls the Decennial Pattern. This pattern has the advantage of being easy to apply, for the I years of every decade are 1921, 1931, 1941, etc.; the II years, 1922, 1932, 1942, and so on.

According to Smith, the IV years are inconclusive, showing fairly even movements in either direction through the decades, so there is little in his work to forecast for the present year, 1944, beyond advice to play 'em close to your vest. In none of the cycle researches studied in gathering data for this article does 1944 appear to be a significant year. The case is very different for 1944. The V years, in the Decennial Pattern, show an excess of nearly 40% of upward movement! Mr. Smith has not linked his ten-year cycle with solar phenomena, but nevertheless it is in striking accord with Dr. Wheeler's sunspot transition yardstick which marks 1945 as a probable boom year.

"Advancing prices are to be expected chiefly in the V, VIII and IX years, while declining tendencies seem preponderantly concentrated in the III, VII and X years," writes Mr. Smith.

Again, an impressive agreement! The VI year in this decade—1946, has been cited by Mr. Dewey as the normal end of a rising price period. The VII year—1947, has been cited as the beginning of a post-war depression by Dr. Wheeler.

Dewey resolutely refuses to make unqualified forecast of any sort, but he does say that for many series of figures he has studied 1947 will mark the beginning of a long downward slide, if the rhythms that have been discovered continue.

Smith agrees that it is a year of declining prices, with, on the average, an excess of 13% of downward movement. The probable center of a sunspot transition in 1949 makes this a likely year of at

[*Continued on page* 150]

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Cycles Predict The Future

[*Continued from page 149*]

least partial recovery, and Mr. Smith marks this IX year as one of advancing prices—starting, in fact, in the preceding VIII year, 1948. With the X year, or 1950, as one of decline, he places the beginning of depression a year or so in advance of other studies.

The Decennial Pattern, like practically all long cycles, breaks down into shorter components: in this case, a 12-month and a 40-month cycle. The dominance of the 40- or 41-month pattern in more than 500 economic series has been brought out by Mr. Dewey.

Cycle studies should encourage profitable conservatism, if only by emphasizing that what goes up must come down. The bodies plopping on the sidewalk back in 1929 (a boom year, remember, before it was a panic year) were those of persons who felt that good times would go on forever. If one is prepared for a possible decline starting in 1947, or realizes that a 1945 boom may turn into panic as did 1929, he is equipped to resist temptations manfully and to take advantage of bargains available when others are pressed to sell. Cycles are not substitutes for intelligence but long-term guides to action—more reliable, statistically, than a myriad economic "laws" which state that the marked "must" act thus-and-so because this-or-that condition obtains.

As an example you might take the 18½-year real estate cycle, which does not state that we are now at, or just past, a peak in values because of crowded war-time conditions, but because a peak was cyclically anticipated. The next real estate low is scheduled for 1952. You can calculate that the war will end in two or three years, that dammed-up building activity will be released, that new transportation methods will open up remote suburbs with cheaper land, that mass-produced prefabricated homes will depress the values of houses now existing, and act accordingly. But you have an equal or better chance of being right, without knowing all the reasons, if you merely operate on the cycle prediction that the trend of real estate in the next eight years will be downward.

As Edgar Lawrence Smith has stated it,

"Man is apparently not so greatly dissociated as he had supposed from all that enables him to live. He is a member not alone of the human race, but of that greater association which includes every form of living thing, each member of which, magnificent or microscopic, responds, it appears, in its own way to the rising and setting of the sun, to the passing of the seasons, and to those less obvious changes in the quantity and content of solar radiant activity which we are just beginning to learn how to observe and to measure."

Our word salary traces its history to the time when Roman soldiers were given salarium, or money with which to buy salt.

Why Not Poison Gas?

[*Continued from page 57*]

in calm and storm. Shooting lung irritants can be effective only when there is no rain and practically no wind.

Mustard gas is incredibly persistent; in enclosed places like basements it may still be active after a full year. Sunshine destroys it as do simple chemicals like chloride of lime. The latter also comes in a watery paste for use on contaminated articles and on the skin. It takes some twenty minutes for the gas to penetrate the skin, a period of grace which enables one to escape being poisoned if proper measures can be taken. There is no thought of the instantaneous action which makes people fall dead after one whiff, as the favorite phrase in pacifist literature goes.

This explains why the German lie about poison gas shells fired against the *Graf Spee* was so clumsy. Naval actions are decided by the shells which hit, and one hit out of each salvo is considered good shooting. It would have been senseless to fire shells with a filler that begins to act half an hour later. In the meantime the enemy can fire enough salvoes to decide the battle the other way round.

That this works in a similar manner on land has been shown in an example during the last war. In March, 1918, the Germans fired 150,000 mustard gas shells into the villages and valleys of the Cambray sector. There were 4,500 casualties, fifty of them died. 150,000 high-explosive shells would have caused more than 4,500 casualties, and certainly a larger number of deaths among the 4,500. And then, of course, the whole sector had to be avoided for many weeks.

All this does not go with modern war and its swift movements. Russian tacticians have come to the conclusion that mustard gas is effective only as a "chemical barbed wire fence," to be used by retreating troops. Naturally the Russians have no reason to use it.

The means of such barrages are all in existence. Howitzers could be used and the bigger varieties of trench mortars. The German six-barreled rocket-firing *Nebelwerfer* was even developed as a chemical weapon. And the Livens Projectors of the first World War may be revived for this purpose. But the chances that this might be done are slim. Modern war is too fast, the laying of gas in concentration takes time. The enemy might move out before the concentration is high. Or he might fight back before that time. Besides if mustard or a similar vesicant is used the contaminated territory has either to be decontaminated or avoided. Both might impede movements. The quick action of the high-explosive shell is more effective and more important than the delayed and lingering action of gas which cannot even be used all the time.

But how about gas from the air?

The story is similar. First there is the threat of

[*Continued on page 152*]

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Why Not Poison Gas?

[*Continued from page* 151]

retaliation; both sides will have to undergo gas if one side starts it. But again: the high-explosive bomb is more effective. Nothing can be done against the explosion, the gas can be fought by decontamination squads. Besides a city, even a bombed city, offers all the facilities for fighting the effects of the gas, something the field does not offer. And it would have to be gas bombs, of course; gas simply released from a high-flying plane would not reach the ground. If the plane flies low it will be shot down if it comes near cities, factories and military establishments. It could do harm only to farmland and farm hands, but if the Nazis were out to do that machine gun bullets would be a lighter load in their planes.

All this does not mean that the Nazis may not try it in the end. Not because they promise themselves miraculous success and a turn in the war, but only for the sake of doing it. But it does mean that such Nazi attempts would not be able to do important harm. And it also means that they'll get back what they start, in about the same ratio as the RAF and the U. S. Army Air Force are paying back the bombs the *Luftwaffe* dropped at the beginning of the war.

Dr. Octane

[*Continued from page* 67]

distinction as a scientist for his work with catalysts. He was given credit for being the first researcher to learn how to use catalysts and put them to work.

In studying the behavior of catalysts under pressure, he also developed the process known as hydrogenation, by which hydrogen is injected into organic substances, thus changing them chemically. This discovery was of immense commercial value and affects our lives daily in many ways.

This research led him to a study of paraffins and he was the first man to make paraffins "go to work." Prior to his experiments, paraffin had been considered a chemically dead substance. But more important, his experiments with paraffins led him into the field of petroleum chemistry—and his work in this field resulted, eventually, in America's triptane gasoline.

In 1930, Dr. Egloff, then Director of Research for the Universal Oil Products Company, hearing of the Russian's remarkable work with catalysts and in petroleum chemistry, persuaded Professor Ipatieff to come to America and helped set him up in a laboratory in Chicago to lend his knowledge to the American petroleum industry. Ipatieff brought his wife to America with him and both of them immediately fell in love with the country.

"Here in America," he said, "I can stay at home in the morning if I don't feel like going to my laboratory. I don't have to go to the government

and obtain official permission to do so."

Later, when Josef Stalin was trying desperately to force the scientist to return to Russia, Ipatieff insisted that this was one of the principal reasons why he wanted to stay in America.

The first fruits of Ipatieff's researches in this country were in the field of improved gasoline. At a dinner given Ipatieff by the American Institute of Chemists last year, Dr. Frank C. Whitmore, in the principal speech of the evening, said:

"If one must pick one lone man who was more responsible than any other for the development of high-octane gasoline, that one man is Ipatieff."

Although many have contributed to the work, Ipatieff is credited as being largely responsible for "100 octane" gasoline, the gasoline now used in our warplanes, and without which those planes could not fight effectively.

But "100 octane" was not good enough for America. Something better was needed. So the attention of petroleum chemists was turned toward triptane.

Triptane, a few years ago, was a laboratory freak. It was a hydrocarbon with a ferocious "kick," more powerful than any other known fuel. However, it cost between $3,000 and $4,000 to produce one gallon of triptane.

American chemists went to work on it and in the first year of the war research had improved upon the methods of producing triptane so that it could be made for about $40 or $50 a gallon. This made it still too expensive for practical use.

Ipatieff and a young assistant, Dr. Vladimir Haensel, attacked the problem in an independent research. Time after time they chased the problem up different scientific alleys, but in vain.

One night, Ipatieff stayed in his laboratory alone, pacing the floor, consulting notations, going over his previous experiments and looking for new leads.

The first light of dawn was coming in the window when Ipatieff suddenly slapped his workbench. He had hit upon a radically new idea. In no time at all, he had solved the mystery of triptane production. By the time his experiment had been completed, the price of a gallon of triptane had come down to $1! Under mass production methods, the price will be even lower.

Triptane, after the war, will permit our automobile and airplane manufacturers to use smaller motors, to obtain more horsepower per pound of weight, to get more miles per gallon of gasoline. Smaller engines will hurry the radical redesigning of automobiles.

Ironically, the man whom Russia branded "an enemy of the proletariat" may very well have contributed a decisive factor in the defeat of Russia's and America's common enemy, Hitler.

Volcanic ash found in Texas is reported to make fine white porcelain, important in view of fine china imports being scarce.

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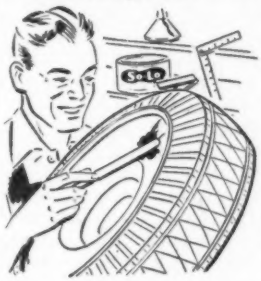

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Weather Vane

[*Continued from page* 130]

noticed by reference to the drawing. The operation of the device is based on what is known as the "selsyn" principle. At the base of the weather vane shaft is mounted a rheostat or coil of resistance wire. With this coil we find two movable points insulated from each other and connected to a small battery.

At a distant point or point of indication, we find what is known as a Gramme ring. This is a circular, soft iron ring wound with wire. It will be noticed from the diagram that these two units, that is, the resistance unit and the winding on the Gramme ring, are connected at three identical points by three wires. Mounted directly in the center of the Gramme ring we find an ordinary compass which may be of the five-and-ten-cent-store variety. The needle of the compass will faithfully follow the movement of the contact moving over the circular resistance coil.

The construction of this kind of indicator is started by winding the Gramme ring. The size of this is not too important. If the builder can find a small soft iron pulley that measures between 4" and 5" across and has a face that measures about 1" or 1½" wide, this will do very nicely. First the spokes of the pulley are sawed out and the last traces removed with a coarse file. Then the entire iron ring is wound carefully with adhesive tape and given a coat of shellac. This makes a nice foundation for the winding which is also shellacked after it has been put in place.

The ring is wound with a single layer of No. 28 double cotton-covered wire. If the spool upon which the wire comes will not pass through the center of the ring, then it will be necessary to rewind the wire on a bobbin that can be passed through the ring freely during the course of the winding. The turns of wire should be wound as tightly and as closely together as possible. When the last turn is wound in position, the covering at the end of the wire is removed. This holds for the beginning of the winding, also. These two raw ends are twisted together and soldered.

Starting out at this point, the builder proceeds to count carefully the number of turns of wire on the entire coil. The resulting figure is divided by three so that the coil can be divided into three independent coils as the wiring diagram specifies. After the coils have been established by counting, then the builder carefully proceeds to remove enough insulation on a single turn of wire at each of the points and to solder carefully a connection of flexible wire. To do this it might be necessary to lift gently the turn to be soldered out of its position and slip a piece of thin fiber underneath it. This will prevent breaking or burning the insulation on the adjacent turn of wire which might eventually cause faulty electrical conditions.

After these connections have been established by soldering, the fiber strip is removed and replaced with a short length of electrical friction tape which is used to cover the soldered joint.

For a professional job, it is necessary to install three binding posts on the base of the instrument. These posts may be fastened on a small strip of bakelite or fiber and all connections should be established by soldering. It is necessary, also, to form a small wooden pedestal for the compass which is mounted in the exact center of the Gramme ring. The compass can be of the ten-cent-store variety; household cement is used to hold it on the pedestal. This is not done until the instrument is finally set up for use, however.

The rheostat or variable resistance element may either be made in the shop or it may be purchased. The supply of 12-volt d.c. may be obtained from a number of sources. Inasmuch as there does not need to be a constant current drain, any dry cell unit will offer long and faithful service. Current need flow only during an actual reading, and so a small switch should be placed in the battery circuit to open it when the equipment is not in use.

The resistance unit will have to be mounted in such a way as to protect it from the elements, and an old auto horn cover is excellent for the purpose. The rheostat unit mounted inside will be snug and comfortable. It will be necessary, also, to solder some sort of bushing on the top of the pressed metal compartment, as will be seen in the drawing.

If the builder wishes to wind his own 360 degrees of variable resistance, this may be done easily. For this purpose a 1" section cut from a piece of 2" or 2½" bakelite or fiber tubing should be obtained. The resistance wire is wound on this in such a way that the two arms or contactors can ride freely over the entire surface of the wire. The resistance of the wire itself may vary over a comparatively wide range but voltage in the circuit will have to be changed accordingly.—*Ramond F. Yates.*

FOR THE DURATION

If your copy of *Mechanix Illustrated* fails to arrive at your newsstand on time, please be patient. Remember that the nation's transportation system is all-out for war, and that distribution of *Mechanix Illustrated* to your area may often be delayed for several days to make way for movements of fighting men and their supplies.

But remember, too that paper rationing has forced a reduction in the number of copies of *Mechanix Illustrated* that can be printed ASSURE YOURSELF OF GETTING YOUR MECHANIX ILLUSTRATED in these days, when it is bringing you more important news than ever before, BY RESERVING YOUR COPY AT YOUR NEWSDEALER'S EVERY MONTH IN ADVANCE.

Terror-Troopers

[*Continued from page 49*]

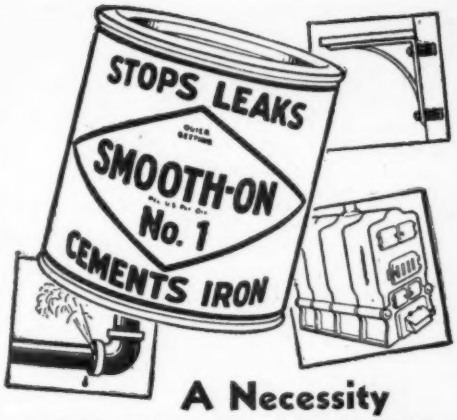
was made safely because an American warship knocked out the enemy searchlights on the hill behind the gun emplacements. Advancing on the town, the Rangers were met by Italians who were eager to surrender and were obliged by being imprisoned in their own jail. The gun crews of the .75's surrendered when half of the guns were knocked out by the accurate fire of the Rangers' handy portable mortars, but the Germans held tenaciously to their position on a mountain behind the town. On the 12th the Germans counter-attacked, but without success. On the 13th they began a steady retreat that carried them back into Italy, the Americans following them closely all the way.

In September the Rangers made their third invasion, crossing from Sicily to Italy. They landed on the 9th at the town of Maiori, north of Salerno. Here they ran into the toughest fighting they had yet encountered. The strongly entrenched Germans fought hard for every inch of ground but were pushed steadily back.

The Rangers were the first American troops to receive the Commando training which is now given to all infantrymen. They proved that American soldiers could take such tough training, which made it possible for them to meet on equal terms the hardened veterans of Rommel's Afrika Korps. But with all troops receiving this training, the need for such specialized units has lessened. The Rangers were pioneers, and the value of the job they did is out of all proportion to their numbers.

Migratory service plants, ranging from station wagons to ten-ton trucks, follow advancing units of America's airplanes on battle duty, ready to diagnose and repair airplane damage.

Most important astronomical instrument of the Middle Ages was the astrolabe, a graduated circle with sights for taking the altitude of sun or stars.



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And we're the folks who will save it!

Save it from *two* things it's *got* to be saved from now.
The first thing is the Enemy. The second is the
danger of Prices Getting Out of Hand.

Here we are this year—after we've paid our taxes
—with 131 billion bucks in our pockets.
But only 93 billion dollars' worth of goods to buy.
That leaves 38 *extra* billion dollars.

Sure, the easy thing to do is to take that 38 billion
and start running around buying things we don't
need, bidding against each other . . . forcing
prices up and up!

Then people want higher wages. Then prices go up
some more—and again wages go up. So do
prices again.

And then where are we!

But us little guys—us workers, us farmers, us
businessmen—are not going to take the easy
way out.

We're not going to buy a single, solitary thing
that we can get along without.

We're not going to ask higher wages for our work;
or higher prices for the things we sell.

We'll pay our taxes willingly, without griping.

We'll pay off all our debts now, and make
no new ones.

We'll *never* pay a cent above ceiling prices.
And we'll buy rationed goods only by
exchanging stamps.

We'll build up a savings account,
and take out adequate life insurance.

We'll buy War Bonds until it really pinches.

Heaven knows, these sacrifices are chicken feed,
compared to the ones our sons are making.

Use it up...Wear it out.
Make it do...Or do without.

HELP US KEEP PRICES DOWN

A United States War message prepared by the War Advertising Council; approved by the Office of War Information; and contributed by the Magazine Publishers of America.

Long Tom

[*Continued from page 70*]

besides. So far Long Tom has not duelled with enemy warships, as far as is known, but that is due mostly to the scarcity of enemy warcraft in the Mediterranean.

In March 1943, Long Toms shelled an enemy airport near Maknassy at long range, destroying five enemy airplanes. At about the same time Long Toms took on the Tenth Panzer Division at 18,000 yards. In spite of the handicap of separate loading ammunition, a battery of four guns produced a little better than one round per minute for an hour. The German tanks crept in to 7,000 yards, a bit too near for the Long Toms, but then turned to retreat. The 155's got them within range again and when the Germans finally retreated out of range they did so minus five tanks which were credited to the battery. They were large ones too, PzKw IV's and PzKw VI's.

An especially interesting artillery duel, with German 105's or heavier on the other side, developed in the Medjez area. The battery of Long Toms changed positions twice, the Germans finding the first two of them and bombing and shelling them furiously for weeks. The Long Toms, sitting undetected in their third position for 18 days in a row, fired daily on a variety of targets. The Germans, unable to find that position, spent a lot of ammunition on the first two that had been abandoned, and even more on a dummy position some 800 yards from the real one.

Finally, on the nineteenth day of this, the Germans did find the true position, but it didn't help them much. The Americans had prepared for just this possibility by digging slit trenches, which protect their occupants except in cases of direct hits or very close misses. Still, the Germans might have inflicted casualties on the battery if their own emplacement had not been such that the American firing officer could see the flash of their guns. Whenever he saw the muzzle flashes of the German pieces he yelled "On the way" to his battery. They could not hear him directly, so that the warning had to be relayed to them, but in spite of this delay they still had some three seconds of grace while the German shells were in the air. During these three seconds they dropped into their slit trenches, then, as soon as the enemy shells had exploded, they clambered out and raced to their own pieces and replied.

After an exchange of several volleys the Germans gave up. Two of their pieces and one of their prime movers were ruined.

After North Africa was won the Long Toms moved on to Sicily. It is a matter of record that enemy resistance—where it occurred—was broken by concentrated artillery fire, the guns being hauled up where bombing failed to do the trick.

Now the Long Toms are in Italy. We are sure to hear more about them before long—indeed, with heavy artillery on first priority along with landing craft, we'll hear plenty.

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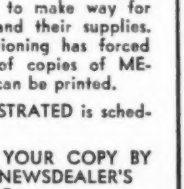

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Continent Of Tomorrow

[*Continued from page 62*]

not only of diamonds but of gold nuggets, during the 1926 drought, without lifting a finger, you might say. The harvest lasted until the rains came and floods followed, which again buried the treasures beneath millions of tons of high waters.

A little town of a few thousand inhabitants, all people connected with the mining industry, is called Tumeremo. Gold is shipped from there up to Ciudad Bolivar on the Orinoco, via airplane, for refining. Some 60,000 ounces a year. They call it the Gold Capital.

The Mayor of Tumeremo is an enterprising office-holder and carries on a considerable mining activity on the side. Which side, is never mentioned. He will grubstake any ambitious "panner." He overcharges them enough for supplies and equipment to defray any under-valuation on their part; which seems fair enough.

Venezuela is lousy with money, and so crazy about it that they have forgotten all about food and progress. No taxes; no public debt. Yet, they don't raise half of what they need to eat. They have to import it or go hungry. They do both—as you'll soon find out by missing good things to eat and paying a scandalous price for what you do eat. Get out of range of the oil companies' good roads, and you will get stuck in a wilderness.

On the map, it looks so easy. The best bet in all South America. Four and a half days and you're there.

High prices and low living standards begin at La Guayra, where your Graceliner lands you. You can't bring anything into the country that is good to eat or to make use of. You fight your way through the customs barrier and the immigration authorities. They motor you 25 miles over the mountains to Caracas, the capital, where they soak you $10-plus for the cheapest room in the best hotel, that would be called second class back home. Haircuts, one dollar up. Cigarettes, 40 cents a pack. Drinks, one dollar. Food, more than double what you were paying for it in America. Cost of clothing, out of sight. So be prepared with a wad when you go to Venezuela.

But don't be discouraged. They've got the goods, if you have the patience to "make them up" and the tact it takes to deal with them.

Perhaps a good line to paste in your hat is, "go south."

However, you might first look over the fine coffee country that lies to the west of Caracas, beyond Lake Maracaibo in the foothills of the Andes. Also there is some of the pleasantest country on the continent over in the direction of Maracay on the road to the seaport, Puerto Cabello. Most anything you find up that way will be easy going, compared with what you are going to go up against "down south." For civilization, such as it is, and equable climate, lie almost wholly in the more populous sections of the north. But the greater fields of opportunity lie in the south.

By "south" is meant a vast area greater than all our Southern States. It has everything, except people, roads and civilization. It is happy hunting ground for pioneers.

In addition to the Orinoco regions, which we have already penetrated in our search for gold and diamonds, there are thousands upon thousands of square miles, where almost every kind of food grown elsewhere in the world can be produced in abundance. The Grand Savannah alone, with its llanos, or prairies without horizon, is capable of sustaining millions of people, dwelling far beyond the coast of Venezuela. In one part or another grow rice, corn, sugar, wheat, beans, potatoes. Even all the beef—and more—that the country is obliged to import in quantity, could be raised well here, with all the complementary by-products. Mahogany and red cedar forests abound—to no profit, because the cost is $170 a thousand, making white pine shipped from the United States, with a high tariff wall to climb besides, cheaper to use.

Why? Well, there are many reasons, all of which can be overcome and cleared aside by *enterprise*. Not money, mind you, because they have plenty of that, but enterprise of that variety for which America is famous.

Throughout this vast region of the south, there is practically not a single all-season highway. There are scarcely enough good roads during any time of the year to carry to market the country's meagre production. The whole of Venezuela, which is 900 miles long, has a total of but 550 miles of railroads. Here is a so-called "agricultural" nation that does not raise enough to feed itself.

Hog raising, horse breeding, poultry, turkey, duck and goat farming could readily be made generally profitable undertakings. For one thing, only a small portion of the endless llanos prairies are fenced, which leads to the mixture of good stock with bad. There is no large-scale cultivation of grain with which to feed livestock, consequently what little is raised is poor in weight and the hides pierced with gadflies and ticks, rendering them unfit for first-quality leather goods. Good flavored fruit abounds everywhere—bananas, pineapples, plantains, mangoes, papayas, breadfruit, avocadoes—but it all suffers from lack of scientific attention and most of it never reaches a market.

If you know the technical answer to any of these questions, then Venezuela is the place for you to seek your fortune tomorrow. But until you can prove your worth, you will find these Venezuelans tough hombres to deal with. After that, if you've got what it takes, you will find them ready to back you to the limit.

A botanist reported that in five years he pulled 37,639 weeds from a plot of ground ten feet square.